Appendix 4. Section 404(b)(1) Alternatives Analysis for the Delta Wetlands Project

Section 404(b)(1) Alternatives Analysis for the Delta Wetlands Project

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September 11, 1995

This document should be cited as:

Jones & Stokes Associates, Inc. 1995. Section 404(b)(1) alternatives analysis for the Delta Wetlands project. September 11, 1995. (JSA 87-119.) Sacramento, CA. Prepared for U.S. Army Corps of Engineers, Sacramento, CA.

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C-062521

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Section 1. Introduction and Summary

Section 404 of the Clean Water Act requires a project proponent to obtain a permit from the U.S. Army Corps of Engineers (Corps) for activities that involve the discharge of dredged or fill material into waters of the United States (33 USC 1344). Section 404 requires that Corps issuance of a permit comply with the requirements of the U.S. Environmental Protection Agency's (EPA's) guidelines for implementing Section 404 (guidelines). EPA's guidelines prohibit discharges of dredged or fill material into waters of the United States if a practicable alternative to the proposed project exists that would have less adverse impacts on the aquatic ecosystem, including wetlands, and that would not have significant adverse impacts on other biological resources. To secure a permit from the Corps when an activity will affect wetlands or other areas determined to be special aquatic sites and that activity is not considered water dependent, the project proponent must demonstrate that no less environmentally damaging practicable alternatives exist.

The purpose of this report is to provide the Corps and EPA with sufficient information to identify the least environmentally damaging practicable alternative associated with the proposed Delta Wetlands (DW) project, and to demonstrate that this alternative complies with the requirements established in EPA's 404(b)(1) guidelines regarding the discharge of dredge and fill material. The EIR/EIS analyzes in greater detail those alternatives that may be considered practicable after preliminary stages of screening.

DW originally applied for water rights to seasonally store water on all four project islands. The DW project, as originally proposed, was analyzed in a draft EIR/EIS released in December 1990. During the period between December 1990 and the release of this document, DW submitted a revised water right application (August 1993) and revised its project description to propose using two islands for water storage and two islands to compensate for wetland and wildlife impacts of the operation of these reservoir islands.

An alternatives analysis was prepared as an appendix of the DW project draft EIR/EIS in 1990. This revised alternatives analysis is being prepared because of changes made to the proposed project and research and regulatory developments concerning water issues in the Delta that have occurred since the first alternatives analysis was prepared. This alternatives analysis includes modifications made in response to comments received from EPA and the Corps on the 1990 alternatives analysis and incorporates subsequent changes in the project description. The analysis also updates information relating to recent policy changes and ongoing projects in the Delta.

PROJECT INTRODUCTION

DW proposes a water storage project on four islands in the Sacramento-San Joaquin River Delta (Delta) (Figure 1-1). The project involves diverting and storing water on two of the islands (Bacon Island and Webb Tract, or "reservoir islands") for later discharge for export sales or to meet outflow requirements for the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) estuary, and seasonally diverting water to create and enhance wetlands and to manage wildlife habitat on the other two islands (Bouldin Island and Holland Tract, or "habitat islands"). The DW project islands (Figure 1-2) are owned wholly or partially by DW, the project proponent. To operate its project, DW would improve levees and install additional siphons and water pumps on the perimeters of the reservoir islands. These activities would necessarily involve discharge activities that would be considered water dependent within jurisdictional waters of the United States. DW's water storage operations would involve inundation of jurisdictional waters of the United States, including wetlands, on the reservoir islands, which would not be considered a water-dependent activity.

A habitat management plan (HMP) was developed for the habitat islands to direct management of these islands to offset wetland and wildlife habitat effects of water storage operations on the reservoir islands. The HMP is described in Section 3 of this analysis. In addition to water storage and habitat management operations, DW would construct recreation facilities on all four project islands to facilitate recreational use of the islands. Development of recreation facilities and habitat management, however, are ancillary to the project's water storage operations and the project purpose. These non-water-dependent activities would involve actions considered discharges into wetlands and other jurisdictional waters of the United States.

The purpose of the DW project is to divert surplus Delta inflows, transferred water, or banked water for later sale and/or release for Delta export or to meet water quality or flow requirements for the Bay-Delta estuary. Additionally, the DW project will incidentally provide managed wetlands and wildlife habitat areas and water-related recreational uses. The purpose of, public need for, and benefit of the project are further described in Section 2 of this analysis.

ALTERNATIVES ANALYSIS REQUIREMENTS OF EPA'S SECTION 404(b)(1) GUIDELINES

EPA's guidelines (40 CFR 230 et seq.), the Corps' regulatory guidelines (33 CFR 320 et seq.), and the National Environmental Policy Act (NEPA) and NEPA guidelines (40 CFR 1500 et seq.) provide the substantive environmental criteria and procedural framework used to evaluate applications for Corps permits for the discharge of dredged or fill material into waters of the United States, including wetlands. Under the Corps' evaluation, an analysis of practicable alternatives is the primary screening mechanism used to determine the appropriateness of permitting a discharge. The Corps' evaluation also includes a public interest review and evaluation of the potential impacts on the environment in compliance with NEPA.

EPA's guidelines prohibit discharges of dredged or fill material into the waters of the United States if a practicable alternative to the proposed discharge exists that would have less adverse impacts on the aquatic ecosystem, including wetlands, and as long as the alternative does not have other significant adverse environmental impacts (40 CFR 230[a]). An alternative is considered practicable if it is available and can be implemented given considerations of cost, existing technology, and logistics in light of overall project purposes; practicable alternatives may include siting a project in areas not owned by an applicant that could be reasonably obtained by the project applicant to achieve the basic project purpose (40 CFR 230.10[a][2]).

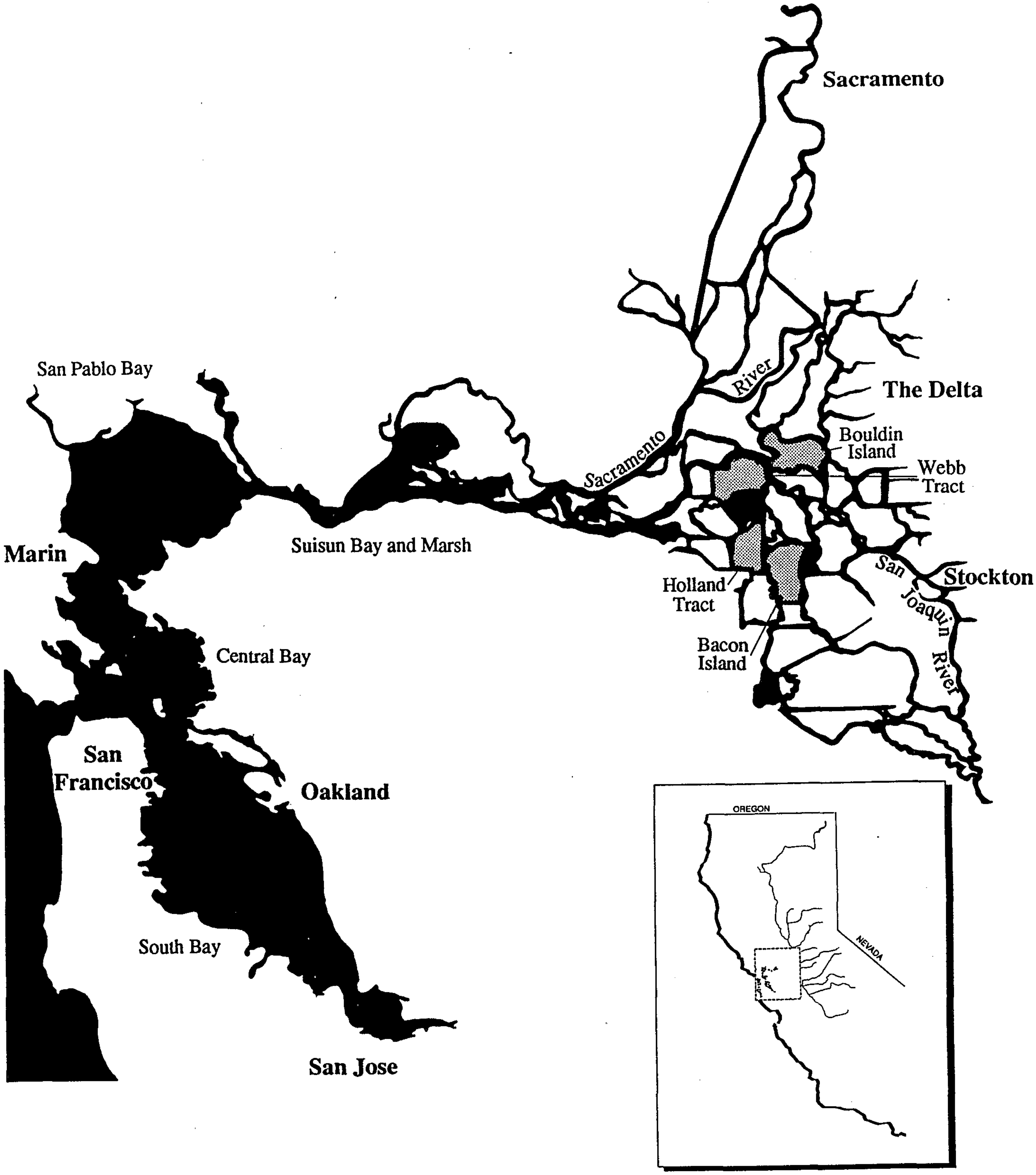
If a project is not water dependent (i.e., does not require access to or siting in special aquatic sites to fulfill the basic purpose) and the project proposes a discharge into a special aquatic site, EPA's guidelines presume that a less environmentally damaging practicable alternative exists unless the project applicant can clearly demonstrate otherwise (40 CFR 230.10[a][2]). Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes. Thus, if a project is not water dependent and would involve discharging dredged or fill material into a special aquatic site, the project applicant must clearly refute the regulatory presumption that a less environmentally damaging practicable alternative exists to obtain a permit for the project.

EPA's guidelines outline a sequential approach to project planning in which mitigation measures are considered only after the project applicant shows that no practicable alternatives are available to achieve the basic purpose with less environmental impact. Once it is determined that no practicable alternatives are available, EPA's guidelines require that appropriate and practicable steps be taken to minimize potential adverse effects on the aquatic ecosystem (40 CFR 230.10[d]). Such steps may include actions controlling discharge location; material to be discharged; fate of material after discharge or method of dispersion; and actions related to technology, plant and animal populations, or human use (40 CFR 230.70-230.77).

ORGANIZATION OF THIS ALTERNATIVES ANALYSIS

This alternatives analysis provides the Corps with information regarding the availability of practicable alternatives to the proposed DW project. The document also demonstrates DW's planning process used in selecting the islands included in the proposed project.

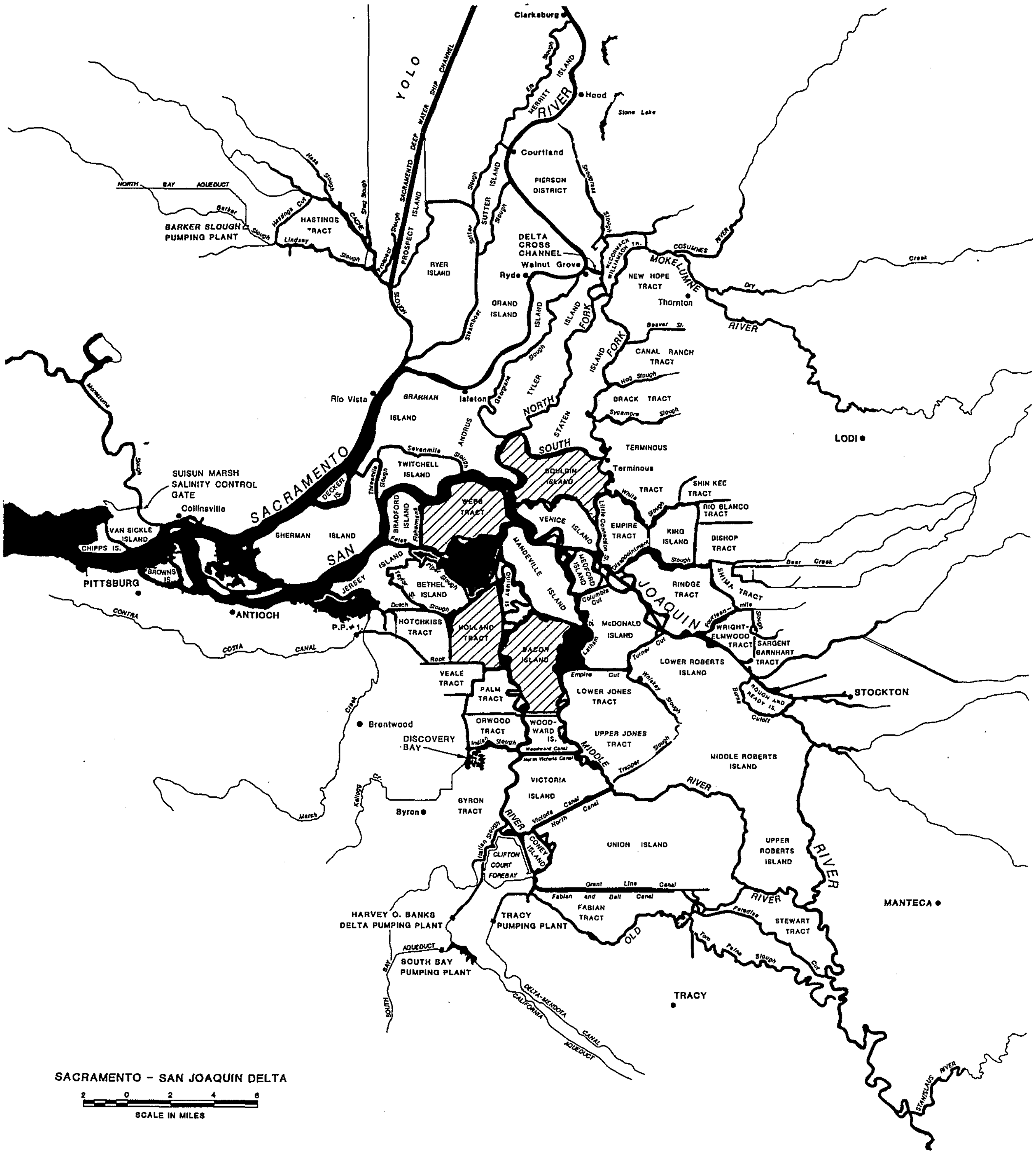
Section 2 of this alternatives analysis establishes the purpose of and need for the DW project and discusses related water resources programs currently planned for the Delta. Section 3 presents the DW project design and site characteristics, including the extent of jurisdictional wetlands on the site, and shows how the proposed project will meet its purpose and need. Section 4 presents the screening approach used to evaluate the potential alternatives. Section 5 describes the various project alternatives and analyzes the practicability of these alternatives with regard to the identified criteria. Section 6 provides a summary of the findings of this analysis. Section 7 is a list of sources used to prepare this analysis.



Source: Adapted from San Francisco Estuary Project 1993

Figure 1-1.
Regional Location of the DW Project Islands

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates



Source: Adapted from California Department of Water Resources 1993.

Figure 1-2.
DW Project Islands in the Delta

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

Section 2. Basic Project Purpose and Need

BASIC PROJECT PURPOSE

The practicability of an alternative to the proposed project is related to whether it is available to the project proponent and can be implemented after cost, existing technology, and logistics are considered in light of the proposed project's purpose (40 CFR 230.10[a][2]). The purpose of the DW project is to divert surplus Delta inflows, transferred water, or banked water for later sale and/or release for Delta export or to meet water quality or flow requirements for the Bay-Delta estuary. Additionally, the DW project will incidentally provide managed wetlands and wildlife habitat areas and water-related recreational uses.

PROJECT NEED AND BENEFIT

The underlying objective of the DW project for the project proponent is the wise and productive use of lands on the four Delta islands owned by DW. The underlying public benefit of the DW project is an increase in the amount of water available for a multitude of beneficial uses. DW proposes to meet the project objective and provide public benefit by increasing the availability of high-quality water in the Delta for export or outflow. The following sections described Delta export demands, Delta water quality needs, and environmental flow requirements that DW project water could be used to satisfy.

Delta Export Demands

Water sent from northern California to central and southern California or to the Bay Area by the State Water Project (SWP), operated by the California Department of Water Resources (DWR), and the Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation (Reclamation), must pass through the Delta. Water is diverted from the Delta by the CVP and the SWP; agricultural users of water from approximately 1,800 local irrigation diversions; and cities such as Antioch and Concord to supply the domestic needs of two-thirds of the state's population and irrigate several million acres of farmlands (DWR 1994). Destinations for DW project water could include the SWP, the CVP, and third-party buyers that use the SWP or CVP facilities for transport of water (a process often referred to as "wheeling").

One source of information regarding the balance between future supply and demand for water in California is DWR's California Water Plan Update (Bulletin 160-93). Bulletin 160-93 estimates that demands for water in California in 2020 will exceed dependable supplies by between 2.9 and 4.9 million acre-feet (MAF) during drought years (DWR 1994). This estimate was made assuming the levels of Delta water supply available under improved water management, existing SWP facilities, implementation of the Central Valley Project Improvement Act (CVPIA) and the 1993 biological opinions for winter-run Salmon and Delta smelt, and operations based on California Water Resources Control Board (SWRCB) 1978 Water Right Decision 1485 (D-1485).

Delta Water Quality Needs

Water quality considerations have a direct bearing on the quantity of Delta water available for use. Delta waters provide a rich habitat for fish and wildlife and are the major source of supply for uses throughout the state. Drinking water for about 20 million Californians flows through the Delta. Water quality parameters such as temperature; turbidity; and oxygen, mineral, dissolved metal, and nutrient content all affect the usability of water and therefore affect the total quantity available for specific uses and the overall availability of water supplies in California. Urban water supplies diverted from the south Delta, for example, face the threat of increasing water quality degradation resulting from both salinity intrusion and the presence of organic substances originating in Delta island agricultural drainage. The pressures of a steadily growing population, additional requirements for water to meet environmental needs, and potentially more frequent water shortages pose serious water management and risk management problems for California. (DWR 1994.)

SWRCB has established specific water quality objectives to protect the uses of water in the Bay-Delta.

Most of these objectives relate to salinity. The SWP and the CVP are required to release sufficient fresh water to meet these Delta salinity objectives. However, DWR estimates that increasingly stringent water quality standards for public health protection will affect the continued availability and cost of water supplies. DWR has recommended that more efforts be made by state and federal agencies to balance the cost of meeting water quality objectives with public health benefits and other benefits of such objectives. (DWR 1994.)

Environmental Flow Requirements

The Bay-Delta estuarine system has long been an important resource to California. More than 100 species of fish use the Bay-Delta system. Some, such as delta smelt and catfish, are year-round residents and others, such as American shad, are in the estuary for only a few months. Some of the species can live only in relatively fresh water and others can survive only in the more saline parts of the Bay. There are also several fish with intermediate salinity tolerance; these are the true estuarine species.

The health of populations of estuarine species is closely linked to the condition of the estuarine environment. The recurrence of drought (both in 1976-1977 and 1987-1992), combined with increasing human demands on water supply, has shown that fish populations and wetland areas require a water supply that is more dependable than that managed now. As a result of natural and human factors, three runs (or races) of chinook salmon in the Central Valley and Klamath/Trinity River system have shown severe population declines in recent years. Additionally, two fish species that use the Bay-Delta estuary, winter-run chinook salmon and delta smelt, are at such low abundance levels that they are listed under the state and federal Endangered Species Acts. An additional fish species, Sacramento splittail, is currently proposed for listing and other fish species are candidates for listing under the federal Endangered Species Act.

Among the many factors affecting the estuarine environment are the rate and timing of freshwater inflow to the estuary; the quantities of fresh water reaching it seasonally, annually, and over a series of years; and diversions from the estuary for both local and export uses. In the past 50 years, developments in the vicinity of the Bay-Delta estuary, along with numerous local, state, and federal water developments on Central Valley tributary streams, caused changes in the timing and amounts of Delta inflows and outflows during most years.

Water development factors having the greatest effect on the Bay-Delta estuary are:

- Delta inflow,
- flows from the Sacramento River through the Delta Cross Channel (DCC),
- reverse flows,
- water project and local agricultural diversions,
- agricultural return flows, and
- Delta outflow and salinity.

SWRCB, through its water right process, provides the principal forum for establishing the Bay-Delta's environmental flow requirements. SWRCB reserves jurisdiction in water right permits and periodically holds water right hearings in which interested agencies and parties provide evidence supporting their views regarding the water right, public interest, or public trust impacts of a permitted use. SWRCB then sets objectives and operating criteria to provide balanced protection to all recognized beneficial uses.

Although SWRCB has adopted the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 WQCP), the flows that may ultimately be required to meet Bay-Delta environmental needs will not be known until the decision-making process currently underway is finalized. The difficulty in predicting the amount of water that may be dedicated to environmental protection is complicated by the variety of ways that are evolving to correct problems associated with the Delta ecosystem and the conveyance of water through the Delta for export.

Analysis of environmental flow needs is based on instream fishery flow needs, flow requirements for wild and scenic rivers, water needs of freshwater wetlands (and Suisun Marsh), and outflow requirements to meet estuarine salinity objectives. DWR calculates that environmental demands for water in California are currently at 28.4 MAF and could increase to 28.8 MAF by 2020 (DWR 1994). DW project water could be used to increase water available to meet environmental flow needs.

RELATED AGREEMENTS, PROGRAMS, AND STUDIES

The agreements, programs, and studies described below are related to environmental conditions in the Delta and to the quantity and/or quality of available water supply in the Delta. These programs and studies therefore address the general public need for additional water supply in the Delta. The discussion of related Delta programs is based in part on DWR's California Water Plan Update (DWR 1994) and on DWR's draft report Relationships between the Projects under Review by the EPA (DWR 1991).

Implementation of most of the programs described in this section remains uncertain. These related programs are long-term projects proposed, for the most part, by local and state agencies that have the appropriate financial and planning resources and public support to invest in long-range programs. The programs are not presented as potential alternatives to the DW project, but to provide a context for analyzing potential alternatives for creating a supply of high-quality water in the Delta for later sale for beneficial uses as Delta export and/or outflow and to provide the framework for analyzing cumulative impacts of the DW project alternatives in the context of other proposed Delta projects.

SWRCB Bay-Delta Proceedings

In 1978, the SWRCB adopted a water quality control plan, known as the Delta Plan, and D-1485. The Delta Plan contained water quality objectives for the protection of beneficial uses of the Delta and Suisun Marsh.

SWRCB reviewed, broadened, and refined the water quality standards of the Bay-Delta estuary during the Bay-Delta hearings. These proceedings, which began in 1987, established reasonable levels of protection for beneficial uses for flow, salinity, temperature, and pollutants. A water quality control plan for salinity, temperature, and dissolved oxygen was completed and adopted by SWRCB in 1991, but was disapproved by EPA because EPA did not believe the plan provided adequate protection for estuarine habitat.

SWRCB subsequently evaluated flow requirements for San Francisco Bay and the Delta and conducted hearings in June, July, and August 1992 to determine whether existing water rights should be amended to achieve, or progress toward achieving, flow and quality standards. On December 9, 1992, SWRCB released interim water quality standards in draft Water Right Decision 1630 (D-1630) to protect fish and wildlife in the Delta and maintain beneficial uses according to the Governor's Water Policy. SWRCB chose not to adopt D-1630.

In response to SWRCB's decision not to adopt interim standards and to the filing of a lawsuit, EPA announced that it would propose draft standards for the Bay-Delta estuary. On January 6, 1994, EPA proposed draft standards for protection of fishery-related beneficial uses in the Delta. SWRCB reviewed EPA's draft standards and conducted public workshops to seek comments and recommendations for standards.

On December 15, 1994, a Bay/Delta Framework Agreement was signed by federal agencies; state agencies; and urban, agricultural, and environmental interests. This agreement:

- identified the amount of water that can be required to be allocated by water rights holders for endangered species protection during average and drought years;
- committed federal agencies not to require additional water allocations for endangered species for a 3-year period;
- placed a limit on the percentage of water that can be exported from the Delta, expressed as percentage of inflow (generally 35% of Delta inflow from February through June and 65% during July through January);
- committed EPA to withdraw its final water quality standards, which were published in January 1995, once SWRCB finalized its water quality control plan;
- dedicated various water users to providing $180 million to fund a variety of improvements to Delta diversion infrastructure; and
- commissioned SWRCB to assign responsibility among the various holders of Delta water rights for maintaining minimum flows during different parts of the year.

Soon after the Framework Agreement was signed in June 1994, SWRCB issued the draft WQCP. This plan set water quality objectives for different points in the estuary, including both numerical salinity objectives and narrative flow and other criteria. These criteria, finalized on May 22, 1995, replaced EPA's draft standards.

CALFED Bay-Delta Program

The Governor's Water Policy (issued in 1992) directed the initiation of the California Environmental Quality Act (CEQA) and NEPA processes to investigate long-term solutions to "fix the Delta". The Bay-Delta Oversight Council was established in December 1992 to guide the search for a long-term solution.

In June 1994, the state and federal governments entered into a Framework Agreement to establish a comprehensive program for coordination on environmental protection and water supply dependability in the Bay-Delta estuary and its watershed. Collectively, these participating agency directors are referred to as CALFED.

Under the Framework Agreement, CALFED will improve coordination of water supply operations with endangered species protection and compliance with water quality standards. CALFED will also develop a long-term solution to fish and wildlife, water supply reliability, flood control, and water quality problems in the Bay-Delta estuary.

CVP and SWP Endangered Species Consultations

On November 30, 1990, winter-run chinook salmon was listed as a threatened species under the federal Endangered Species Act (the species' listing was subsequently changed to endangered on February 3, 1994). Delta smelt was listed as a threatened species on April 5, 1993, and listings of other Delta species (e.g., longfin smelt, Sacramento splittail, and steelhead trout) are being considered. Winter-run chinook salmon and delta smelt are also listed under the California Endangered Species Act. Under the federal Endangered Species Act, a "take" is prohibited unless a specified level of take is authorized by National Marine Fisheries Service (NMFS) (winter-run chinook salmon) or U.S. Fish and Wildlife Service (USFWS) (other Delta species considered for listing) in an incidental take statement. Take is a loosely defined term that includes harassment of and harm to a species, entrainment, directly and indirectly caused mortality, and actions that adversely modify or destroy the species' habitat.

NMFS, USFWS, and California Department of Fish and Game (DFG) have consulted with the Reclamation and DWR on joint CVP/SWP operations. Long-term restrictions on project operations to protect winter-run chinook salmon were issued by NMFS in its biological opinion issued February 12, 1993. DFG subsequently adopted NMFS's long-term biological opinion.

NMFS, USFWS, Reclamation, DWR, and DFG are implementing recovery efforts to protect and restore the winter-run chinook salmon, including restricting in-river and ocean harvest, reducing losses to diversions along the Sacramento River (e.g., intakes to Anderson-Cottonwood and Glenn-Colusa Irrigation Districts), implementing artificial propagation, and establishing a captive breeding program. In September 1992, NMFS formed a recovery team to develop a federal recovery plan (required by the federal Endangered Species Act) for winter-run chinook salmon. (DWR 1994.)

Pursuant to the December 15, 1994 agreement between the state and federal governments regarding the water quality standards for the Delta, USFWS issued a biological opinion for long-term protection of delta smelt on March 6, 1995, for CVP and SWP operations. The biological opinion for winter-run chinook salmon was revised in May 1995 and was issued by NMFS in summer 1995.

Coordinated Operations Agreement

The Coordinated Operations Agreement (COA), signed in 1986, provides for joint management of the CVP and SWP by Reclamation and DWR to ensure that water quality objectives established by SWRCB will be achieved. The COA provides not only for an equitable sharing of Delta water supplies, but also for conjunctive operation of the CVP and SWP to allow the projects to maximize benefits to both parties. Under the COA, Reclamation also agreed to meet future water quality standards established by SWRCB, unless the Secretary of the Interior determines that the standards are inconsistent with congressional intent.

Subarticle 10(h) of the COA was approved by Congress in 1988 and provides for negotiations of a wheeling contract between DWR and Reclamation whereby DWR could meet some of its future delivery obligations using federal water, and Reclamation could increase deliveries south of the Delta by using state facilities. Reclamation may have some water available for delivery on an interim basis to areas south of the Delta but has limited pumping and conveyance capacity. DWR, however, has excess pumping and conveyance capacity but limited water supplies.

Scoping meetings for this proposal were held in 1989. A scoping report was released in January 1991.

Preparation of a draft environmental impact report/environmental impact statement (EIR/EIS) on this proposal is being delayed until a decision is made on Delta water rights and Bay-Delta water quality and flow standards, and until guidelines for implementing the CVPIA have been adopted (see "Central Valley Project Improvement Act" below).

Banks Pumping Plant Fish Protection Agreement

DWR installed four additional pumping units at SWP's Harvey O. Banks Delta Pumping Plant near Clifton Court Forebay. These units became operational in 1993 and increase total pumping capacity from 6,400 cubic feet per second (cfs) to 10,300 cfs. These pumps provide DWR with standby capacity and allow DWR to pump the quantity of water specified in its Corps permit over a shorter period. The Corps permit requirements limit pumping to 6,680 cfs plus one-third of San Joaquin River flow at Vernalis during the mid-December to mid-March period whenever those flows exceed 1,000 cfs. An exceedance of this limit would require modification of the existing authorization from the Corps or an individual permit.

To mitigate fish losses at Delta export facilities, both the SWP and the CVP have entered into agreements with DFG. During the environmental review process for installation of the four additional pumps at Banks Pumping Plant, DFG and DWR began negotiating an agreement for the preservation of fish potentially affected by the operation of the pumps. A unique aspect in the development of this agreement was the assistance provided by an advisory group made up of representatives from United Anglers, the Pacific Coast Federation of Fishermen's Associations, the Planning and Conservation League, and the State Water Contractors. (DWR 1994.)

The Fish Protection Agreement, signed by the directors of DFG and DWR in December 1986, identifies the steps needed to offset adverse fishery impacts of Banks Pumping Plant operations. The agreement establishes a procedure to calculate direct fishery losses annually and requires DWR to pay for mitigation projects that would offset the losses. Losses of striped bass, chinook salmon, and steelhead trout are to be mitigated first. Mitigation of losses of other species are to follow as impacts are identified and appropriate mitigation measures are found. In recognition of the fact that direct losses today would probably be greater if fish populations had not been depleted by past operations, DWR also provided a one-time $15 million mitigation fund. (DWR 1994.)

Central Valley Project Improvement Act

Title 34 of the Reclamation Projects Authorization and Adjustment Act of 1992 (HR 429, now noted as Public Law 102-575) is known as the CVPIA. The act makes significant changes to the management of this federal reclamation project and creates a complex set of new programs and requirements applicable to the project. The act covers five primary areas: limitations on new and renewed CVP contracts, water conservation and other water management actions, water transfers, fish and wildlife restoration actions, and establishment of an environmental restoration fund (DWR 1994).

The act establishes a $50 million annual habitat restoration fund and instructs Reclamation to allocate 800 thousand acre-feet (TAF) of water annually (600 TAF in a dry year) to the environment by 2002. The act also secures approximately 500 TAF in annual water supplies for Trinity River flows, Central Valley wildlife refuges, and the Grasslands Water District. With certain conditions, the act provides that those receiving CVP water can transfer all or a portion of that water to others. The act restricts new contracts for water supplies from the CVP for any purpose other than to benefit fish and wildlife, and the act requires the establishment of an office for CVP water conservation best management practices.

Reclamation, in its role as operator of the CVP, and USFWS, as directed by the Secretary of the Interior, are beginning to establish the interim guidelines and procedures necessary to implement the act's provisions; however, it will take a number of years to complete all the actions called for in the legislation (DWR 1994). Reclamation is working to complete a programmatic EIS analyzing implementation of the environmental restoration components of the act.

DWR Delta Water Management Programs

DWR is developing water management programs for the south, north, and west Delta. These programs will address the water resource problems unique to each region of the Delta, in the context of the entire Delta, statewide water supply projects, and the Governor's Water Policy.

North Delta Program

The North Delta Program study area encompasses the Delta region north of the San Joaquin River from Threemile Slough eastward. Limited channel capacity in the north Delta has contributed to two major problems: reverse flow in the San Joaquin River (a consequence of SWP and CVP exports from the Delta) and repeated flooding of local leveed tracts. The intent of the North Delta Program is to allow greater floodflows to pass safely, while lowering flood levels throughout the area by dredging channels and building new setback levees to provide greater flood protection for Thornton and Walnut Grove and other Delta islands. Increasing channel capacity and reducing or eliminating reverse flows would create a more efficient means of transferring water through the north and central Delta, therefore providing additional water supply for SWP users and improving water quality. The North Delta Program will be investigated as a long-term solution and possibly as an interim action. (DWR 1994.)

South Delta Program

The South Delta Program area encompasses Union and Roberts Islands, Stewart Tract, and other lands near Tracy (DWR 1988a). The program's objective is to reconcile the water supply priorities of Reclamation, the CVP, and the SWP with needs for improved water quality while maintaining recreational opportunities in the south Delta. Water quality problems in the south Delta primarily relate to deleterious effects of water diversions by the CVP and SWP and by agriculture.

The Interim South Delta Water Management Program was initiated in response to an October 1986 agreement between DWR, Reclamation, and the South Delta Water Agency. The Interim South Delta Preferred Alternative includes:

- adding an intake structure for the SWP at Clifton Court Forebay;
- performing limited channel dredging in Old River north of the forebay;
- providing four flow-control structures to control water levels, circulation, and flow in the South Delta channels and to assist salmon migration in the San Joaquin River; and
- obtaining a Corps permit to allow the SWP to increase its existing pumping capacity of the Banks Pumping Plant up to 10,300 cfs during high-flow periods.

The Interim South Delta Water Management Program could augment the water supply of the SWP by an average of approximately 60 TAF per year (TAF/yr). (DWR 1994.)

West Delta Program

The West Delta Program addresses four major issues: flood control, water quality, wildlife concerns, and water supply reliability. The objectives of the West Delta Program are to:

- improve levees for flood control,
- protect Delta water quality,
- acquire island properties for development of diverse waterfowl and wildlife habitats,
- meet water supply and water quality needs of Sherman Island,
- minimize soil erosion and land subsidence,
- protect the reliability of the SWP and the CVP,
- identify potential wildlife habitat mitigation opportunities for present and future development projects,
- protect highways and utilities, and
- provide additional recreational opportunities.

Conversion of land from agriculture to managed wildlife habitat on Sherman and Twitchell Islands is the primary focus of the West Delta Program. Because of their location, 10,000-acre Sherman Island and 3,500-acre Twitchell Island are important for protecting the reliability and quality of the Delta water supply, providing wildlife habitat, and protecting highways and utilities.

DWR published an initial study and negative declaration on the proposed Sherman Island Wildlife Management Plan (DWR 1990b), under which the 10,000-acre Sherman Island would be operated as a wildlife management area by DFG. A framework agreement was signed by DWR and DFG on June 24, 1991, on the suitability of Sherman and Twitchell Islands to serve as mitigation for the Clifton Court Forebay enlargement component or another feature of the South Delta Program.

DWR Delta Levee Maintenance Program

Subventions Program

Maintenance and improvement of levees in the Delta are normally conducted by local reclamation districts using matching funds from DWR or the Federal Emergency Management Agency (FEMA). The procedures and funding for levee work have recently been altered by Senate Bill 34 (SB 34) (the Delta Flood Protection Act of 1988), which increases state funding for flood protection. The DWR subventions program was changed in the following ways by SB 34:

- annual funds available rose from $2 million to $6 million;
- state cost sharing for local assistance programs increased from 50% to 75%;
- reimbursements were made available for levee improvements and maintenance, items formerly disallowed by FEMA; and
- requirements were established for DFG approval of reclamation district plans to ensure that no net loss of wildlife habitat occurs.

Special Projects

In addition to the subventions program adjustments outlined above, SB 34 called for DWR to prepare plans and priorities for flood protection and subsidence studies and monitoring on eight western Delta islands and the towns of Walnut Grove and Thornton. Of the DW islands, Webb and Holland Tracts are included in the eight islands, for which $6 million will be provided annually. The eight islands, if permanently flooded, would pose a significant threat to Delta water quality because of increased evaporation and increased upstream movement of ocean salts and substantial loss of available Delta water supply (DWR 1988b, 1990a). Recent activities include planning and designing major levee rehabilitation projects for Twitchell Island and New Hope Tract; repairing vulnerable levee sites on Sherman Island, Twitchell Island, Bethel Island, and Webb Tract; and conducting other special projects and studies to determine the causes of Delta land subsidence (DWR 1994).

Delta Ecological Studies

DWR, DFG, Reclamation, and SWRCB are participating in an Interagency Ecological Program (IEP) in the Delta. The study program is intended to improve understanding of fish and wildlife requirements in the Bay-Delta estuary and establish operating criteria for the CVP and SWP export pumps to protect fish and wildlife.

Several specific topics are examined in the IEP. The populations, habitat requirements, and effects of flows on striped bass, salmon, and the species of concern and methods of reducing fish kills by pumps and diversions have been explored. Water quality issues have also been investigated, especially algal blooms, drought effects, and improved water quality modeling. Efforts have focused on the Delta, Suisun Marsh, and San Francisco Bay to determine the actions needed to maintain habitat quality in those ecosystems.

DWR Offstream Storage South of the Delta

To increase the amount of water available to SWP customers, DWR has proposed constructing several offstream storage facilities south of the Delta.

Los Banos Grandes

DWR proposed to construct the Los Banos Grandes project, an offstream reservoir complex located on Los Banos Creek in western Merced County, to serve as a south-of-the-Delta water banking unit for the SWP. Los Banos Grandes would store Delta winter flows pumped from the Delta through the California Aqueduct during the wet months (November-April). Los Banos Grandes would be infeasible without the South Delta Program. (DWR 1991.)

A draft EIR was released to the public for review in December 1990. The review and comment period ended September 30, 1991. Los Banos Grandes requires a Section 404 permit from the Corps under the Clean Water Act. A notice of intent to prepare a draft EIS was released in February 1991 with the Corps as the lead agency under NEPA. However, due to the recent Endangered Species Act actions in the Delta and changes to water quality standards, the feasibility of the project is being reassessed. The actual sizing and schedule is highly dependent on the selection of a long-term solution for resolving fishery issues and facilitating efficient water transfer through the Delta.

Kern Water Bank

The Kern Water Bank is defined as the collective opportunity to store and extract SWP water in the Kern County groundwater basin under a contract between DWR on behalf of the SWP and the Kern County Water Agency. The Kern Water Bank consists of eight potential elements or separate components. Seven of the elements would be sponsored by local water districts, and the eighth element would be DWR's Kern Fan Element. A programmatic EIR was completed for the Kern Fan Element in 1986. However, DWR is awaiting an assessment of the availability of future water supply for the project. For now, the planning program is focused on completion of a habitat conservation plan, incidental-take permits for terrestrial species in the Kern Fan Element area, and analysis of project economics. Once an adequate water supply is identified, the Kern Fan Element will be reassessed, final environmental documentation will be issued, and a program for further evaluation of local elements will be considered. If feasible, the Kern Fan Element would be developed to store as much as 1 MAF of water and contribute as much as 140 TAF per year to the SWP in drought years.

SWP Coastal Branch Project, Phase II

The Coastal Branch Project, Phase II, will complete the Coastal Branch of the SWP's California Aqueduct. The 102-mile buried pipeline would transport SWP water to San Luis Obispo and Santa Barbara County Flood Control and Water Conservation Districts. This project would deliver a total of about 5 TAF/yr to San Luis Obispo County and 42 TAF/yr to Santa Barbara County.

The final EIR for the Coastal Branch Project was released in May 1991 and the notice of determination was filed in July 1992. Construction began in late 1993 and is scheduled to be completed in early 1997 (DWR 1994).

CCWD Los Vaqueros Project

The Los Vaqueros Project, under construction by Contra Costa Water District (CCWD), will consist of a 100 TAF reservoir within the Kellogg Creek watershed and associated appurtenant facilities, including a new supplemental Delta intake location, conveyance pipelines, a transfer reservoir, pumping plants, and other facilities necessary for project operation. Water diverted from the new Delta intake location will be pumped to the Los Vaqueros Reservoir site during periods when Delta water quality is good. In late summer and fall, when Delta water quality deteriorates, reservoir water to be used within CCWD's service area will be released and blended with Delta water from direct diversions from Rock Slough to reduce salinity.

CCWD has a contract with Reclamation, under Reclamation's existing water right for CVP water, for 195 TAF/yr, which would be adequate to meet CCWD's future water needs. Because of physical constraints in CCWD's delivery system, current diversions are limited to approximately 135 TAF/yr. Currently, CCWD diverts approximately 120-130 TAF/yr of water from Rock Slough, the amount diverted depending on the water-year type. CCWD can also divert up to 26,780 af/yr of water from Mallard Slough in the Delta, although water is rarely diverted because of poor water quality. The Los Vaqueros Project would change the timing of CCWD's diversions and could affect the proportion of water diverted from the Delta during various times of the year.

A draft EIR/EIS for the Los Vaqueros Project was issued for public review on March 3, 1992. After public review, a final Stage II EIR/EIS for the Los Vaqueros Project was published on September 27, 1993, and a Section 404 permit was issued by the Corps in May 1994. A water right decision on the project was issued by SWRCB in June 1994.

Montezuma Wetlands Project

The Montezuma Wetlands Project, a privately financed project, would use deposited dredged materials on a diked bayland site adjacent to the Suisun Marsh in Solano County to restore 1,822 acres of tidal wetlands (including some seasonal wetland features). The proposal calls for constructing facilities to receive up to 20 million cubic yards of approved dredged materials from ports and navigation channels in the San Francisco Bay estuary and to distribute the dredged materials over the site to raise the subsided land surface to an elevation range at which marsh habitat could become established.

The project's potential benefits include restoration of a tidal marsh ecosystem at a scale unprecedented for the region, which could support abundant wildlife, fish, estuarine production, and a diversity of marsh species (including special-status species) and habitats. The project would also provide significant capacity for disposal of sediments dredged from Bay Area ports or navigation channels. The project's potential adverse impacts include loss of established seasonal wetlands and endangered species populations and a possible release of contaminants from dredged materials into the marsh system.

A draft EIR/EIS for the Montezuma Wetlands Project was issued by Solano County and the Corps in October 1994 (Corps and Solano County 1994). The public review period for the EIR/EIS ended on December 19, 1994. A final EIR/EIS is expected to be completed in July 1995 (Glas pers. comm.).

Delta Water Transfers

Water obtained under a water right can be transferred by the water right holder to another party. Water transfers can be used to help meet water supply shortages with possibly fewer environmental impacts and less cost than construction projects. Short-term (1 year or less) temporary transfers require SWRCB approval but are exempt from CEQA compliance, whereas long-term transfers require full CEQA compliance.

SWRCB must approve water transfers that require changes in terms or conditions of existing water right permits. SWRCB does not intend to approve long-term transfers through the Delta until a full assessment of cumulative environmental impacts is prepared.

DWR (1994) describes the functioning of the 1992 State Drought Water Bank, a temporary water transfer program, and provisions of the CVPIA regarding water transfers.

Reoperation of Folsom Dam and Reservoir

Reclamation and the Sacramento Area Flood Control Agency (SAFCA) are considering options involving the reoperation of Folsom Reservoir to permit the containment of a 100-year or larger flood event in the American River watershed. The options are interim measures until the Corps completes a study of permanent reoperation of Folsom Reservoir and a plan is authorized by Congress. Two interim reoperation options, which would maintain maximum flood storage capacities at Folsom Reservoir of 670 TAF and 800 TAF, respectively, were analyzed by Reclamation and SAFCA in an environmental assessment/EIR (EA/EIR). The EA/EIR found that substantial impacts on water supply, hydropower, and other resources dependent on water surface elevations in the reservoir can be avoided or mitigated (SAFCA and Reclamation 1994).

This study evaluates the impacts of increasing the dedicated flood control space in Folsom Reservoir. Study results will be used to decide whether Folsom Dam and Reservoir will be reoperated on a permanent basis to provide increased levels of flood protection to the Sacramento area. If reoperation occurs, storage space now used for water supply, power production, and recreation would be used instead for flood control mitigation. A draft reoperation plan and draft EIS will be issued in 1995. When completed and authorized by Congress, the plan will replace Reclamation's and SAFCA's interim reoperation plan described above.

East Bay Municipal Utility District Activities

American River Diversions

The East Bay Municipal Utility District (EBMUD) contracted with Reclamation in 1970 to purchase up to 150 TAF/yr from the American River watershed for delivery by diversion into the Folsom-South Canal at Nimbus Dam, immediately below Folsom Reservoir. In 1972, the Environmental Defense Fund and others filed a lawsuit that seeks to prevent EBMUD from diverting water from the American River; Reclamation was not a party to this lawsuit. In late 1984, the court appointed SWRCB as referee and directed the board to conduct an investigation and prepare a report on 21 specific legal, technical, and public trust issues.

In June 1988, SWRCB issued its final report responding to the instructions of the court. SWRCB recommended that EBMUD be allowed to divert water from the Folsom-South Canal subject to specified river flow limitations.

A final decision was issued in May 1990 by the court. According to this decision, EBMUD may divert 150 TAF/yr of water from the Folsom-South Canal pursuant to the contract of December 22, 1970. Instream flow requirements are set at 2,000 cfs for October 15 through February, 3,000 cfs for March through June, and 1,750 cfs for July through October 15. However, the current EBMUD board has decided not to divert water from the American River at this time.

Water Supply Management Program

In 1989, EBMUD developed a Water Supply Management Program to identify the actions and projects necessary to provide a dependable water supply to communities of the eastern San Francisco Bay Area. One action proposed by the program was the construction of a 145-TAF terminal reservoir called Buckhorn Reservoir. In January 1989, EBMUD released the final EIR and the technical report for the district's program. The final EIR was the subject of litigation, and EBMUD decided to reevaluate the proposed project and other facility improvements.

A new EIR/EIS for the updated Water Supply Management Program and water supply improvement projects was prepared by EBMUD and the Corps. The present program includes six options: one involving raising Pardee Reservoir, two groundwater banking options using either American River or Mokelumne River water, a Delta diversion option using American River water under the EBMUD contract with Reclamation, a conservation-only option, and an option for groundwater use only. EBMUD has identified a need for 130 TAF of water in 2020.

After several hearings and extensive evaluation, EBMUD's board of directors designated two of the six composite programs as preferred alternatives. The main element of each alternative is the use of groundwater storage. One of the preferred alternatives would store available surface water in an underground basin during wet years and draw from the storage during dry years for agricultural irrigation to augment flows in the lower Mokelumne River or pump into the aqueducts for use by EBMUD's customers. Another preferred alternative includes the same components mentioned above, plus a supplemental water supply from the American River. (DWR 1994.)

Activities of the Metropolitan Water District of Southern California

Arvin-Edison/Metropolitan Water District Storage and Exchange Program

The Arvin-Edison Water Storage District (Arvin-Edison), in partnership with the Metropolitan Water District of Southern California (MWD), is proposing a water storage and exchange program that would extend through 2035. During years of storage (when additional SWP water is available), MWD would store SWP water in Arvin-Edison's groundwater basin. During years of recovery, MWD would receive a portion of Arvin-Edison's CVP supplies in exchange for water MWD previously placed in storage in Arvin-Edison. The proposed alternative would result in the additional diversion of approximately 1 MAF from the Delta over the approximately 45-year life of the program. (EIP Associates 1992.) A draft EIR/EIS was issued in January 1992. However, recent actions to protect aquatic species in the Delta and implementation of the CVPIA have restricted operations in the Delta. Consequently, MWD and Arvin-Edison are currently reassessing the project (DWR 1994).

Domenigoni Reservoir Project

The proposed reservoir in western Riverside County would be constructed in Domenigoni Valley near the junction of the Colorado River Aqueduct, the San Diego Canal, and the SWP East Branch Aqueduct. The reservoir would have a capacity of 800 TAF. The reservoir would receive water, when available, from various sources through the Colorado River Aqueduct and SWP delivery facilities with some shift of SWP deliveries from summer to winter. The project would provide emergency storage, carryover, seasonal storage; preserve operating reliability; provide substantial wildlife mitigation; and optimize groundwater recharge programs. (DWR 1994.)

A draft EIR was issued in June 1991, and a final EIR was issued in October 1991. The final EIR was certified early in 1992, and mitigation and construction design is ongoing. The current MWD schedule indicates that the project would be operational by the end of this decade. However, it could take about 5 or more years to fill the reservoir, so the full benefit of the reservoir may not be realized until after 2004 (DWR 1994).

CONCLUSION

Implementation of the majority of the programs described above remains uncertain because state/federal coordination of the Delta standards is ongoing and because of uncertainty regarding implementation of the CVPIA. These related programs are long-term projects proposed, for the most part, by local and state agencies that have the appropriate financial and project planning resources and public support to invest in long-range programs.

Section 3. Proposed Project Features

DW proposes a project involving diversion and storage of water on two Delta islands (Bacon Island and Webb Tract, or "reservoir islands") for later discharge for export sales or to meet outflow requirements for the Bay-Delta estuary, and seasonally diverting water to create and enhance wetlands and to manage wildlife habitat on the other two islands (Bouldin Island and Holland Tract, or "habitat islands"). DW proposes constructing recreation facilities along the perimeter levees on all four DW project islands; operating a private airstrip on Bouldin Island; and, during periods of nonstorage, managing shallow water, which may provide wetland habitat values on the reservoir islands. The DW project islands are owned wholly or partially by DW. To operate its proposed project, DW would improve and strengthen levees and install additional siphons and water pumps on the perimeters of the reservoir islands. DW would operate the habitat islands primarily to support wetlands and wildlife habitat.

At the time of DW's 1987 application to the Corps for a Section 404 permit, all four islands were in agricultural production at varying levels of intensity. Bacon and Bouldin Islands were being farmed intensively; Holland and Webb Tracts were unevenly cultivated because of drainage and other problems related to recent island flooding due to levee breaches.

OVERVIEW OF PROJECT OPERATIONS

The project applicant's proposed project consists of storage of water on two reservoir islands and implementation of a habitat management plan (HMP) on two habitat islands. The operational scenarios presented below as Alternatives 1 and 2 both represent DW's proposed project and differ only with regard to operating criteria for discharge of stored water. Analysis of the proposed project as represented by these two alternatives allows potential impacts of DW's proposed project to be evaluated for the full range of likely DW operations. An additional operational scenario, Alternative 3, consists of use of all four of the DW project islands as reservoirs and provision of limited compensation habitat on Bouldin Island. All alternatives are designed to operate consistently with the objectives of SWRCB's 1995 WQCP.

General Overview

Alternatives 1 and 2 entail the potential year-round diversion and storage of water on two Delta islands owned by DW (Bacon Island and Webb Tract) and wetland and wildlife habitat creation and management, with the incidental sale of the water used for wetland and wildlife habitat creation, on two Delta islands owned primarily by DW (Bouldin Island and Holland Tract) (Figure 3-1). All the land required for the DW project is currently owned by DW or controlled under an option agreement. The reservoir island operations may include shallow-water management during periods of nonstorage at the discretion of DW and incidental to the proposed project. To operate Alternative 1 or 2, DW would improve levees on the perimeters of the reservoir islands and install additional siphons and water pumps. Inner levee systems would also be constructed on both the reservoir and habitat islands for shallow-water management.

Under Alternative 1 or 2, during periods of availability throughout the year, water would be diverted onto the reservoir islands to be stored for later sale or release. Water would be discharged from the islands into Delta channels for sale for beneficial uses for export or for Bay-Delta estuary needs during periods of demand throughout the year, subject to state and federal regulatory standards, endangered species protection measures, and Delta export pumping capacities. Water discharged into the Delta channels under proposed project operations would mix with Delta inflows from the Sacramento and San Joaquin Rivers and other tributary rivers and would be available as either export water or Delta outflow (e.g., outflow necessary to satisfy 1995 WQCP objectives or other state or federal standards). DW project operations can be adjusted on a daily basis according to hydrologic information and information on fish abundance and location obtained through monitoring.

The DW project islands could also be used for interim storage of water being transferred through the Delta from sellers upstream to buyers served by Delta exports or to meet Bay-Delta estuary outflow requirements (water transfers), or for interim storage of water owned by parties other than DW for use to meet scheduled Bay-Delta estuary outflow requirements or for export (water banking). Such uses could occur only after the transferrers or bankers of the water applied to SWRCB for rights to new points of diversion or rediversion onto the DW project islands. The frequency and magnitude of these transfer/banking activities is uncertain at this time; each would require separate authorization and may require further environmental documentation beyond that provided for the DW project.

During periods of nonstorage, DW could choose to divert water onto the reservoir islands under riparian claim or senior appropriative water rights for wetland habitat management; typically, diversion would begin after September 1, after an appropriate dry period to allow for growth of wetland plants of value to wintering waterfowl as forage and cover. Wetland habitat created on the reservoir islands would be flooded as storage water becomes available. The inner levee system constructed on each reservoir island would manage shallow-water circulation during nonstorage periods.

Water would be diverted onto the habitat islands to be used for wetland and wildlife habitat creation and management during periods of availability and need. Most likely, the water diversions for wetland management would begin in September and water would be circulated throughout winter. Except for small areas of permanent water, water used on the habitat islands would be discharged on a schedule related to wetland and wildlife values, with drawdown typically by May. As an incidental operation, the water released at this time from the habitat islands may be sold or used for the same purposes as water released from the reservoir islands.

Portions of the habitat islands and the reservoir islands would support recreational activities. Waterfowl hunting would be allowed on all four DW project islands; upland bird hunting would be allowed on the reservoir islands and in specific areas on the habitat islands. Private recreation facilities, including as many as 30 boat berths per facility in adjacent channels and 36 boat berths per facility on the island interiors, vehicle access and parking, and living accommodations, would be located along the perimeter levees on all four DW islands. There may be as many as 38 private recreation facilities on the four islands developed over the life of the project, and each facility may accommodate up to 40 bedrooms. The recreation facilities on all four islands may be operated to support year-round use of the boat docks. Recreational use and location of the recreation facilities on the habitat islands would be subject to restrictions of the HMP; recreational use on the reservoir islands would depend on water storage operations.

A private airstrip located on Bouldin Island would be operated to support DW recreational and maintenance activities. The airstrip is currently used for agricultural operations.

The DW project would also establish an environmental research fund to sponsor research on resources that may be affected by the DW project or in other areas of the Delta.

The following sections describe DW's proposed project in detail and describe the differences between the two operational scenarios for the proposed project presented as Alternatives 1 and 2.

Reservoir Islands

Bacon Island and Webb Tract would be managed for water storage under Alternatives 1 and 2. Facilities that would be needed for the proposed water storage operations include intake siphon stations with auxiliary pumps to divert water onto the reservoir islands and pump stations to discharge stored water from the islands. DW proposes to construct two intake siphon stations on each reservoir island with 16 new siphons each, for a total of 64 siphons. One discharge pump station with 32 new pumps would be installed on Webb Tract and a pump station with 40 pumps would be installed on Bacon Island, for a total of 72 new pumps. Where possible, existing siphons and pumps would be modified or upgraded (e.g., by installation of fish screens on siphons) and reused for water operations. Figures 3-2 and 3-3 show the proposed locations of siphon and pump stations and recreation facilities on Bacon Island and Webb Tract, respectively. DW has proposed locations for these facilities; flexibility exists to choose other locations for the siphon and pump stations before initial construction if, at the end of the CEQA/NEPA process, the lead agencies determine that different locations are desirable because of channel hydraulics or environmental, water quality, or other considerations. Reservoir island operations and features are described below.

Water Storage Operations

Storage Capacity. The reservoir islands would be designed for water storage levels up to a maximum pool elevation of +6 feet relative to mean sea level (based on

National Geodetic Vertical Datum data) providing a total estimated initial capacity of 238 TAF, allocated between Bacon Island and Webb Tract as 118 TAF and 120 TAF, respectively. Water availability, permit conditions, and requirements of the DWR Division of Safety of Dams (DSOD) may limit storage capacities and may result in a final storage elevation of less than +6 feet.

The total physical storage capacity of the reservoir islands may increase over the life of the project as a result of soil subsidence (local or regional sinking, mainly resulting from the oxidation of peat soil in the Delta). Subsidence on the reservoir islands is currently estimated to average 2-3 inches per year and is thought to be caused mostly by agricultural operations. With water storage operations replacing agricultural operations, the rate of subsidence on the reservoir islands is expected to be greatly reduced, although some subsidence may still occur. No method currently exists to predict the rate of subsidence on a Delta island used for water storage operations. DW estimates, however, that the reservoir islands could subside at a rate of approximately 0.5 inch per year, even with the cessation of agricultural operations and possible sedimentation during filling and storage. Under this hypothetical scenario for subsidence on the reservoir islands, the storage capacity of the reservoir islands could increase by as much as 9% in 50 years, increasing total storage capacity of the reservoir islands to 260 TAF.

Siphon Station Design. Two new siphon stations for water diversions would be installed along the perimeter of each reservoir island. Each siphon station would consist of 16 siphon pipes 36 inches in diameter. Fish screens to prevent entrainment of fish in DW diversions would be installed around the intake end of each existing and new siphon pipe. The individual siphons would be placed as close together as possible but would be spaced at least 40 feet apart to incorporate fish screen requirements (Figure 3-4). DW could use the existing reservoir island siphons for diversions to create shallow-water wetland habitat. In-line booster pumps would be available on the reservoir islands to supplement the siphon capacity during final stages of reservoir filling.

Pump Station Design. One discharge pump station would be located on each reservoir island. The pump stations would have 32 new pumps (on Webb Tract) or 40 new pumps (on Bacon Island) with 36-inch-diameter pipes discharging to adjacent Delta channels. Typical spacing for the pumps would be 25 feet on center (Figure 3-5). An assortment of axial-flow and mixed-flow pumps would be used to accommodate a variety of head conditions throughout drawdown. Actual rates of discharge of each pump would vary with the remaining pool elevations. As water levels decrease on the islands, the discharge rate of each pump also would decrease. Existing pump stations on the islands may be modified and used when appropriate to help with dewatering or for water circulation for water quality purposes.

Diversion and Discharge Operations. The DW project alternatives are designed to operate within the objectives of the 1995 WQCP and consistently with Corps requirements for maximum SWP exports. The following discussions define terms used to describe DW project operations in the context of Delta operations criteria; explain the criteria for diversions under Alternatives 1 and 2; describe the assumed operating criteria for discharges under Alternative 1; and describe the assumed criteria for discharges under Alternative 2, contrasting them with those for Alternative 1.

Definition of Terms. Following are definitions of several terms used below to describe the manner in which the project alternatives would operate relative to 1995 WQCP requirements and other conditions:

- **Export limits**. The 1995 WQCP specifies that Delta exports are limited to a percentage of total Delta inflow (generally 35% during February-June and 65% during July-January).
- **Outflow requirements**. The 1995 WQCP specifies Delta outflow requirements that encompass water quality protection for agricultural and municipal and industrial uses, Suisun Marsh, and fish habitat. In standard DWR calculations of Delta operations (using the water balance model known as "DWRSIM"), "outflow" represents the difference between inflow and exports; the outflow term used in this chapter therefore includes in-Delta consumptive use.
- **Available water**. Under the 1995 WQCP, available water is total Delta inflow less Delta outflow requirements.
- **Allowable export**. Water allowable for export under the 1995 WQCP is the lesser of the amount specified by the export limits (i.e., percentage of total Delta inflow) and the amount remaining after outflow requirements are met (i.e., available water).
- **Physical export pumping capacity**. The SWP export pumps have a maximum physical pumping capacity of 10,300 cfs and the CVP export pumps have a maximum physical pumping capacity of 4,600 cfs, for a combined phy-

sical export pumping capacity of 14,900 cfs. At times, the canal capacity for the CVP is reduced to 4,200 cfs, reducing the combined physical export pumping capacity to 14,500 cfs.

- **Permitted pumping rate**. The Corps does not require a permit under Section 404 of the Clean Water Act for current SWP export pumping. However, the Corps would require a permit if SWP export pumping were to exceed a maximum 3-day average rate of 6,680 cfs. Therefore, the maximum combined export pumping rate that does not require a Corps permit is 11,280 cfs (6,680 cfs for the SWP pumps and 4,600 cfs for the CVP pumps). The restrictions for the period of December 15 to March 15, as interpreted by DWR, allow a combined rate of 11,700 cfs in December and March and a combined maximum 3-day average rate of 12,700 cfs in January and February. For assessment of the DW project alternatives, it is assumed that the SWP and CVP pumps will always pump the maximum amount allowable (i.e., the lesser of available water and the amount specified by the export limits) within the limits of the permitted pumping rate.

- **Future permitted export pumping capacity**. In the future, new permit conditions may be established for the SWP, thereby allowing the permitted export pumping rate of the SWP pumps to be increased to the physical export pumping capacity of 10,300 cfs. If that occurs, the combined permitted export pumping rate of the SWP and CVP pumps could then equal up to 14,900 cfs or 14,500 cfs.

- **Actual exports**. Actual exports are the least of the following: the amount specified by the export limits (i.e., as percentage of inflow), available water (i.e., water available after outflow requirements are met), and permitted export pumping rate.

- **DW discharge for export**. DW may sell its stored and discharged water to buyers south or west of the Delta who would arrange to have the purchased water transported to areas of use through either the SWP or CVP aqueducts. The term "wheeling" is often applied to this process of transporting water owned by the purchasing entity through the SWP or CVP aqueducts.

Diversions under Alternatives 1 and 2. Under Alternatives 1 and 2, DW diversions are treated consistently with the 1995 WQCP objectives for Delta exports at the SWP and CVP pumping plants. That is, DW diversions are considered to be the same as SWP and CVP exports in complying with the WQCP objectives, although DW's applied-for water rights for diversions would have a lower priority than the senior SWP and CVP water rights.

DW direct diversions or diversions to storage could occur in any month, but would occur only when the volume of allowable water for export (i.e., the lesser of the amount specified by the export limits and the amount of available water) is greater than the permitted pumping rate of the export pumps. This would occur when two conditions are met: 1) when all Delta outflow requirements are met and 2) when the export limit is greater than the permitted pumping rate, so that water that is allowable for export is not being exported by the SWP and CVP pumps. Situations may exist, however, in which the SWP and CVP may not be pumping at capacity because of low demands during winter, maintenance activities, or other circumstances, but DW would still be able to divert water for storage.

Figure 3-6 shows two examples of months with opportunities for DW diversion to storage. The panel on the left shows a month with 40,000 cfs of total Delta inflow when the export limit is 35% of inflow and when required outflow is 7,000 cfs. The permitted pumping rate of 11,280 cfs limits CVP and SWP exports to less than the export limit of 14,000 cfs (35% of 40,000 cfs), providing an opportunity for DW diversions of 2,720 cfs (14,000 cfs - 11,280 cfs).

The panel on the right in Figure 3-6 illustrates a month with total inflow of 20,000 cfs when the export limit is 65% of inflow (13,000 cfs) and when required outflow is 4,000 cfs. In this month also, CVP and SWP exports are limited by permitted pumping rate, so that DW has an opportunity to divert 1,720 cfs, the difference between the export limit and the permitted pumping rate (13,000 cfs - 11,280 cfs).

Discharges under Alternative 1. For Alternative 1, the EIR/EIS analysis assumes that discharges of water from the DW islands would be exported in any month when unused capacity within the permitted pumping rate exists at the SWP and CVP pumps and strict interpretation of the export limits (percentage of total Delta inflow, or "percent inflow") specified in the 1995 WQCP does not prevent use of that capacity. Such unused capacity could exist when the amount of available water (i.e., total inflow less Delta outflow requirements) is less than the amount specified by the export limits.

Figure 3-7 presents an example of DW discharges for export under this alternative. In the example, total Delta inflow is 20,000 cfs in a month with an export limit of 35% of inflow, or 7,000 cfs. The outflow requirement is 14,000 cfs, leaving only 6,000 cfs of available water (20,000 cfs - 14,000 cfs). The difference between the 35% export limit and the available water (7,000 - 6,000 = 1,000 cfs) could present an opportunity for export of DW releases.

Under this alternative, DW discharges would be treated as additions to total Delta inflow. Export of DW discharges thus would be limited to the lesser of the permitted export pumping capacity and the amount calculated under the "percent inflow" export limit, based on the adjusted inflow amount (20,000 cfs + DW additions to inflow). For example, if DW water is released and exported at the DW maximum monthly average discharge rate of 4,000 cfs, the adjusted total Delta inflow would be 24,000 cfs and the adjusted export limit would be 8,400 cfs (35% of 24,000 cfs). With this adjusted export limit, the opportunity for DW discharge for export would be 2,400 cfs (8,400-cfs export limit - 6,000 cfs of available water). The remainder of the 4,000-cfs DW discharge (1,600 cfs) would be added to Delta outflow.

Under Alternative 1, DW has two choices regarding allocation of discharges. If DW chooses to discharge at the maximum DW discharge rate, some of the releases must be used to increase Delta outflow while the balance is exported, as shown in this example. Alternatively, DW could choose to limit discharges so that no allocation to Delta outflow is needed. In this same example, if DW were to release only 1,500 cfs, the adjusted inflow would be 21,500 cfs and the adjusted export limit would be 7,525 cfs (35% of 21,500 cfs), allowing the 1,500-cfs DW discharge to be exported, along with the 6,000 cfs of available water, without an allocation to Delta outflow.

Discharges under Alternative 2. Under Alternative 2, it is assumed that releases of water from the DW islands would be exported by the SWP and CVP pumps during any month when unused capacity within the permitted pumping rate exists at the SWP and CVP pumps. DW discharges would be allowed to be exported in any month when such capacity exists and would not be subject to strict interpretation of the export limits (percentage of total Delta inflow). It is assumed that Alternative 2, like Alternative 1, would operate in the context of current Delta facilities, demand for export, and operating constraints. Under this alternative, it is assumed that export of DW discharges is limited by the 1995 WQCP Delta outflow requirements and the permitted combined pumping rate of the export pumps but is not subject to strict interpretation of the 1995 WQCP "percent of inflow" export limit.

Figure 3-7 shows an example of an opportunity for DW discharge for export under this alternative. For the example month, total Delta inflow is 20,000 cfs when the export limit is 35% of inflow and when required outflow is 14,000 cfs. Total inflow less required outflow would leave 6,000 cfs available for export by the CVP and SWP. Maximum DW discharge of 4,000 cfs could be exported under this alternative, for a total Delta export of 10,000 cfs. The export limit of 7,000 cfs (35% of 20,000 cfs) would not limit export of the DW discharge.

Timing and Rate of Diversions onto the Reservoir Islands. The timing and volume of diversions onto the reservoir islands would depend on how much water flowing through the Delta is not put to reasonable beneficial use by senior water right holders or required for environmental protection and would be subject to operational terms and conditions of project approval. DW proposes to develop a procedure to coordinate DW project diversions with SWP and CVP operations on a daily basis to ensure that DW diversions capture only available Delta flows, satisfy 1995 WQCP water quality objectives, and maximize efficiency of the DW water storage operations.

Diversion rates of water onto the reservoir islands would vary with pool elevation and water availability. The maximum daily average rate of diversions onto either Webb Tract or Bacon Island would be 4,500 cfs (9 TAF per day) at the time diversions begin (i.e., when head differential [the pressure created by water within a given volume] between channel water elevation and the island bottom is greatest). The diversion rate would be reduced as the reservoirs fill and the head differentials diminish. Booster pumps would be used to complete the filling process. The combined maximum daily average rate of diversion for all the islands (including diversions to habitat islands, described below) would not exceed 9,000 cfs. The combined maximum monthly average diversion rate would be 4,000 cfs; at this average rate, both reservoir islands could be filled in approximately one month.

Estimated mean monthly diversions under Alternatives 1 and 2 are shown in Table 3-1. This table presents an overview of estimated DW project operations but does not show the pattern of estimated operations, which includes values that vary widely from the average values.

Timing and Rate of Discharges from the Reservoir Islands. DW proposes to discharge stored water from the reservoir islands during periods of demand in any month, subject to Delta regulatory limitations and export pumping capacities. Discharges would be pumped at a combined maximum daily average rate of 6,000 cfs. The combined monthly average discharge rate of the reservoir islands, however, would not exceed 4,000 cfs; at this average rate, both reservoir islands could be emptied in approximately one month. The pump station pipes would discharge underwater to adjacent Delta channels.

Estimated mean monthly discharges from the reservoir islands under Alternatives 1 and 2 are shown in Table 3-1.

Shallow-Water Management on the Reservoir Islands

Incidental to project operations, Alternatives 1 and 2 could include shallow-water management on Bacon Island and Webb Tract to enhance forage and cover for wintering waterfowl when water would not be stored on the reservoir islands. DW would not be required to create wetland habitat on the reservoir islands to compensate for impacts on wildlife or wetland resources resulting from water storage operations; compensation habitat is provided on the habitat islands under the HMP. Creation of wetland habitat on the reservoir islands would be implemented at DW's discretion.

DW would construct and maintain an inner levee system on the bottoms of the reservoir islands. The system would consist of a series of low-height levees and connecting waterways and would manage shallow water during periods of nonstorage. The inner levees would be broad earthen structures similar to the structures currently in place on existing farm fields.

When water is not being stored on the reservoir islands, the islands could be flooded to shallow depths (approximately 1 acre-foot of water per acre of wetland) for creation of wetland habitat, typically 60 days after reservoir drawdown. During years of late reservoir drawdown, additional time may be necessary before shallow flooding begins to allow seed crops to reach maturity. Once shallow flooding for wetland management occurred, water would be circulated through the system of inner levees until deep flooding occurred or through April or May. If the reservoir islands were not deeply flooded by April or May, water in seasonal wetlands would be drawn down in May, and if no water were available for storage, the island bottoms would remain dry until September, when the cycle would potentially repeat. Incidental to the shallow-water management, DW could potentially sell that water when it was drawn down in April or May.

Recreation Facilities

Water storage operations on Bacon Island and Webb Tract would not preclude recreation on those islands. DW proposes to construct a maximum of 11 recreation facilities on each of these islands along the perimeter levees, as shown in Figures 3-2 and 3-3. Each recreation facility would be constructed on approximately 5 acres and would include living quarters with a maximum of 40 bedrooms, a 30-berth floating dock with a gangway that provides access from neighboring water channels, a 36-berth floating dock on the interior of the island to provide small-boat access to hunting areas, and a 40-car parking lot located along the levee crest access road.

DW Environmental Research Fund

The DW project, once operating, would contribute $2 per acre-foot of water sold for Delta export to a research fund established to sponsor related research work. No monies from the fund will be allocated to fulfill project permit requirements. Rather, it is intended that the fund pay for research in those areas that may be affected by the DW project and in other areas in the Delta.

The fund would be administered by DW, and an invited committee would be established to decide how research funds would be allocated. The committee will likely include representatives from DFG, USFWS, NMFS, SWRCB, DW, fishery-oriented and waterfowl-oriented organizations, and one general environmental organization.

Operations and Maintenance

Operation and maintenance activities for the reservoir islands under Alternatives 1 and 2 would include:

- operation of onsite siphons and pumps during water diversions and discharges;
- inspections and maintenance of perimeter levees, including placement of fill and rock revetment as needed;
- maintenance of inner levees for shallow-water management and management of reservoir bottoms;
- maintenance and monitoring of siphon units and fish screens;

- inspections and maintenance of pump and siphon stations; and
- maintenance and operation of recreation facilities.

Habitat Islands

Bouldin Island and Holland Tract would be managed for wetlands and wildlife habitat under Alternatives 1 and 2 (Figures 3-8 and 3-9). An incidental operation of the habitat islands may involve the sale or use of water required to be drained from the islands. This water would be sold or used for the same purposes as the water discharged from the reservoir islands.

The primary function of the habitat islands, as described in the HMP, is to offset the effects of water storage operations on state-listed threatened and endangered species, waters of the United States (including wetlands) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, other wildlife habitat areas, and wintering waterfowl. The habitat islands would be developed and managed to provide breeding and foraging habitat for special-status wildlife species and other important wildlife species groups. The amounts and types of wetlands and other habitats developed on the habitat islands would compensate for the impacts of project facility construction and water storage operations on the reservoir islands and any impacts associated with construction and operation of the habitat islands.

Wetland management on the habitat islands would require grading areas, revegetating, and diverting water. As part of Alternatives 1 and 2, improvements would be made to existing siphon and pump facilities and to perimeter levees, including levee buttressing to meet DWR's recommended standards for levee stability and flood control. No new siphon or discharge pump stations would be constructed on the habitat islands. Recreation facilities would be constructed on the habitat island perimeter levees, and the Bouldin Island airstrip would be operated to support maintenance and recreational activities on the DW project islands.

Habitat Island Diversions and Discharges

Bouldin Island and Holland Tract would be managed for improvement and maintenance of wetland and wildlife values. The timing and volumes of diversions onto the habitat islands would depend on the needs of wetlands and wildlife habitat. Wetland diversions would typically begin in September and water would be circulated through winter. Existing siphons would be used for diversions to the habitat islands. Fish screens would be installed on all siphons used for diversions.

The maximum rate of proposed diversions onto Holland Tract and Bouldin Island would be 200 cfs per island. Diversions onto the habitat islands would not cause the combined maximum daily average diversion rate of 9,000 cfs for all four DW project islands to be exceeded. The estimated water budget for the habitat islands is presented in Appendix A1, "Delta Monthly Water Budgets for Operations Modeling of the Delta Wetlands Project". Water would be applied to the habitat islands in each month for management of acreages of open water and perennial wetlands, flooded seasonal wetlands, and irrigated croplands specified in the HMP. Approximately 19 TAF would be diverted annually onto the habitat islands.

Water would be discharged from the habitat islands based on wetland and wildlife management needs. Typically, water would be drawn down by May and the habitat islands would remain dry until September, except for permanent water areas and other areas kept wet because of vegetation needs. Existing pumps would be used for discharges and for water circulation on the habitat islands. If new appropriative rights were approved for the water diverted onto the islands for wetland and wildlife management needs, DW could potentially sell that water when it is discharged; however, such discharge will not conflict with the HMP.

The maximum rate of proposed discharges from Bouldin Island and Holland Tract would be 200 cfs per island. Discharges from the habitat islands for export would not cause the combined maximum daily average discharge rate of 6,000 cfs and the maximum average monthly rate of 4,000 cfs for all four DW project islands to be exceeded.

Recreation Facilities

Recreation facilities on the habitat islands would be similar to those described above for the reservoir islands. Consistent with the HMP, DW would construct up to 10 new recreation facilities on Bouldin Island and six new recreation facilities on Holland Tract. The HMP designates open hunting areas for waterfowl and upland hunting, as well as closed zones where hunting is prohibited.

The Bouldin Island airstrip would be available for use by hunters and other recreationists to fly to the island.

The airstrip is currently used for agricultural operations. To reduce disturbances to wildlife, restrictions specified in the HMP have been placed on operation of fixed-wing aircraft and helicopters on the habitat islands during the waterfowl season.

Operation and Maintenance

Operation and maintenance activities for the habitat islands under Alternatives 1 and 2 would include:

- operation and routine maintenance of the siphon and pump units;
- management of habitat areas, including, but not limited to, the control of undesirable plant species, agricultural plantings and irrigation, and the maintenance or modification of inner levees, circulation ditches, canals, open water, and water control structures to facilitate flooding and drainage;
- maintenance and monitoring of fish screens during water diversions for habitat maintenance;
- wildlife and habitat monitoring for the HMP;
- inspections and maintenance of perimeter levees;
- use of the Bouldin Island airstrip for seed dispersal and application of herbicides and other pesticides;
- operation of recreation facilities; and
- monitoring and enforcement of hunting restrictions.

FISH SCREENS

Fish screens would be installed around the intake end of each existing and new siphon pipe (Figures 3-4 and 3-10). The screens would be designed and operated to prevent entrainment and impingement of most adult and juvenile fish that are present in the Delta. DW has proposed fish screen design criteria, which are part of the project to be evaluated. Final fish screen design characteristics, such as approach velocity, mesh size, flow uniformity, and cleaning frequency, may be modified through negotiations with USFWS, NMFS, and DFG to ensure effective operation under all Delta conditions.

The proposed fish screen design consists of a barrel-type screen on the inlet side of each siphon with a hinged flange connection at the water surface for daily cleaning (Figure 3-11). Each siphon opening would be enclosed by stainless steel woven wire mesh screen (7 by 0.035 = seven openings per inch in screen of 0.035-inch-diameter number 304 stainless steel wire) with a pore diagonal of 0.1079 inch. Siphon pipes, with their individual screen modules, would be spaced approximately 40 feet apart on center.

DW proposes to design the screens for a maximum initial average approach velocity of 0.33 feet per second (fps). The average approach velocity would decrease rapidly as the islands are filled because the head differential of the siphons would decrease with island filling. The fish screens would be sufficiently strong to withstand handling and cleaning and would withstand at least a 24-inch head differential in water levels.

The screens would be monitored daily to determine the need for cleaning and assess damage from floating logs, boats, or other causes. Spare screen modules would be available to replace damaged screens and thus ensure the reliable performance of the screens. Algae and other clogging debris would be removed from the screens as required by agreement with DFG, USFWS, and NMFS. Removal methods may include regularly raising the screen modules out of the water and brushing or spraying the screens.

Real-time fish monitoring would be performed at each siphon station by sampling of siphoned water at the discharge end of the selected siphon. In addition, siphoned water could be periodically sampled at the expansion chamber of each siphon. Sampling protocol would be subject to fishery agency requirements for the Delta. The monitoring efforts could be coordinated with other regional monitoring efforts.

EXTERIOR SLOPES OF EXTERIOR LEVEES

DW proposes to continue the current levee maintenance and vegetation management programs conducted by the reclamation districts on the four DW project islands. The programs include mechanical and chemical maintenance methods.

COORDINATION WITH WATER RIGHTS, DELTA STANDARDS, AND FISH TAKE LIMITS

The project's permits, if granted by SWRCB, would contain terms and conditions to protect prior water right holders and the public interest and public trust. All existing and any future Delta standards regarding water quality, flows, and diversions would be applicable to the DW project alternatives as appropriate. The project permits would require that project diversions not interfere with the diversion and use of water by any other user with riparian or prior appropriative rights.

Coordination regarding Senior Water Rights

Most holders of riparian and senior appropriative water rights are located upstream of the Delta in the Sacramento or San Joaquin River Basins. Many holders of riparian rights are located in the Delta, and senior appropriative water rights are also held in the Delta by the SWP and the CVP, as well as CCWD and several smaller diverters. The DW project would not interfere with diversions by these senior water right holders.

The DWR Division of Operations and Maintenance and Reclamation's Central Valley Operations Coordinating Office (CVOCO) maintain the official daily water budget estimates for the Delta and designate the Delta condition each day as being "in balance" or "in excess" relative to all SWRCB objectives and water right terms and conditions. The term "in balance" indicates that all Delta inflow is required to meet Delta objectives and satisfy diversions by CCWD, the CVP, the SWP, and Delta riparian and senior appropriative water users. Under all circumstances, when the Delta condition is designated to be in balance, no additional water would be available for diversion by the DW project under new water rights.

When DWR and CVOCO determine the Delta condition to be in excess and other terms and conditions are met, the DW project would be allowed to divert available excess water for storage on the designated reservoir islands under new appropriative water rights. DW diversions under existing riparian and senior appropriative rights may be permitted for shallow-water management, subject to applicable water right laws, even when the Delta is not determined to be in excess. The daily quantity of available excess water would be estimated according to DWR's normal accounting procedures. To provide extra protection for compliance with the 1995 WQCP, SWRCB may establish requirements for amounts of water within the designated excess water (i.e., buffers) that would not be available for DW diversions, or other measures to protect Delta objectives, existing water right holders, and public trust values. Nevertheless, during major runoff events, excess Delta inflow will likely be available for diversion by the DW project (see Chapter 3A, "Water Supply and Water Project Operations").

Coordination regarding Water Quality Standards

All existing and any future Delta water quality standards adopted by SWRCB or other regulatory agencies would be applicable to the proposed diversions. Project operations for water storage would not be allowed to violate applicable Delta water quality objectives and public trust values or interfere with the ability of other projects to meet the objectives.

The DW project permits would contain terms and conditions that specify the allowable project operations for a variety of possible Delta conditions related to water quality or fish and wildlife requirements. SWRCB terms and conditions for the requested DW water rights would specify DW operational rules and guidelines related to meeting applicable Delta objectives.

Coordination regarding Endangered Species

Under the federal Endangered Species Act, biological opinions would identify DW project operational criteria, take limits, and facility design (i.e., fish screen criteria) for winter-run chinook salmon, delta smelt, and possibly Sacramento splittail. The project permits would require that project operations fully comply with any applicable Endangered Species Act conditions and allowable take limits as specified in the biological opinions. Water exported from the DW reservoir islands will be subject to all applicable biological opinion requirements at the SWP and CVP export facilities.

PROPOSED PROJECT'S WATER DEPENDENCY

As previously discussed, EPA's guidelines presume that a less environmentally damaging practicable alternative exists if a project is not water dependent and the project would involve a discharge into a special aquatic site, unless the permit applicant can clearly demonstrate otherwise. The basic purpose of the DW project is to divert surplus Delta inflows or transferred or banked water for later sale and/or release for Delta export or to meet water quality or flow requirements. Additionally, the DW project will incidentally provide managed habitat areas and water-related recreational uses.

The intake and discharge structures of the project are considered water dependant, but the water storage, habitat, and recreational aspects are not considered water dependant.

SECTION 404 JURISDICTION ON THE PROJECT SITE

Waters of the United States include coastal and inland waters, lakes, rivers, and streams that are navigable waters of the United States, including adjacent wetlands; tributaries to navigable waters of the United States, including adjacent wetlands; interstate waters and their tributaries, including adjacent wetlands; and all other waters of the United States. Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3, 40 CFR 230.3).

The two reservoir islands that are part of the DW project currently contain some jurisdictional wetlands, but will not be considered jurisdictional wetlands once they are in operation. The existing habitat values on those islands will be replaced in their entirety by the development of the two habitat islands pursuant to the HMP.

Total Jurisdiction on the Project Site

Existing jurisdictional wetlands on the 20,129 acres of the DW project islands were delineated and classified into habitat types during vegetation mapping (Table 3-2). The delineation was verified by the Natural Resources Conservation Service (NRCS) in consultation with the Corps in 1995. NRCS identified two types of jurisdictional wetlands on the project islands as defined by provisions of the Food Securities Act and Section 404 of the Clear Water Act: artificial wetlands and prior converted cropland (Simpson and Coe pers. comms.). Listed below are the 10 habitat types in the project area (which does not include nonproject areas on Holland Tract) that qualify as jurisdictional waters of the United States, totaling approximately 763 acres:

- **Riparian Cottonwood-Willow Woodland.** Approximately 122 acres of riparian cottonwood-willow woodland exist on the project site. Riparian cottonwood-willow woodland is generally older than 5 years and contains cottonwood saplings and trees taller than the willow scrub understory.

- **Riparian Willow Scrub.** Approximately 81 acres of riparian willow scrub exist on the project site. Riparian willow scrub is generally less than 5 years old with four species of willows mixed with cottonwood seedlings.

- **Freshwater Perennial Marsh.** Approximately 56.1 acres of freshwater perennial marsh exist on the project site. This habitat type is characterized by herbaceous plant species in which rooting medium is inundated by water for long periods, if not indefinitely. This habitat type is typically associated with riparian and open water habitats in relatively undisturbed locations. Dominant plants include cattail, tule, bulrush, other emergent wetland species, and buttonbush.

- **Exotic Marsh.** Approximately 147 acres of exotic ruderal habitats exist on the project site. This habitat type consists of former agricultural fields, which, for various reasons, were abandoned or left for more than 2 years and subsequently had been invaded by dense stands of exotic herbaceous weeds. Typical weedy species include nettle, annual smartweed, peppergrass, field mustard, wild radish, dallisgrass, curly dock, amaranth, and watergrass.

- **Perennial Ponds.** Approximately 111 acres of perennial ponds exist on the project site. Perennial ponds, consisting primarily of blowout ponds, are lined with dense riparian or emergent wetland vegetation.

- **Canals and Ditches.** Approximately 95 acres of canals and ditches exist on the project site. Canals and ditches consist of the yearly average area occupied by open water in major island drains.

- **Grain and Seed Crops**. Approximately 3 acres of corn that is rotated with wheat are in one field on Webb Tract.

- **Annual Grassland**. Approximately 110 acres of annual grassland exist on the project site. This habitat is typically on drier sites associated with the broad, gentle interior slopes of perimeter levees. Typical annual grassland species include wild oats, canary grass, ripgut brome, mustard, and bur-clover.

- **Exotic Perennial Grassland**. Approximately 17 acres of exotic perennial grassland exist on the project site, all on Webb Tract. This habitat type typically is found on interior slopes of levee perimeters on sites that maintain soil moisture intermediate to sites occupied by annual grassland and exotic ruderal habitats. Typical exotic perennial grassland species include Bermuda grass, perennial ryegrass, saltgrass, and Johnson grass.

- **Unvegetated Disturbed Areas**. Approximately 21 acres of unvegetated disturbed areas exist on the project site, all on Webb Tract. This habitat consists of former grassland habitats adjacent to levees that have been scarified as a result of levee and road maintenance activities.

Jurisdictional Waters Affected by the Proposed Project

In administering EPA's guidelines, the Corps assumes that practicable alternatives exist to filling special aquatic sites for non-water-dependent uses. Special aquatic sites, as defined by EPA's guidelines (40 CFR 230.4-230.45), include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes. Most of the jurisdictional waters that would be affected by implementation of the proposed project are considered special aquatic sites.

Table 3-3 shows acreages of jurisdictional wetlands on the DW project islands that would be affected by implementation of the proposed project. The precise locations of recreational facilities on project islands are not yet know. The estimates of impacts of the project on jurisdictional wetlands that is shown in Table 3-3 are based on a worst-case scenario regarding the location of these facilities in relation to wetlands and special-status species. Approximately 394 acres of the jurisdictional waters on the reservoir islands would be affected by implementation of the proposed project, primarily by inundation during water storage operations. A small portion of jurisdictional wetlands would be affected by placement of island bottom materials as fill to buttress the islands' perimeter levees against wave erosion and to construct new interior levees.

On the habitat islands, approximately 78 acres of exotic marsh habitat would be affected by conversion of those areas to other habitat types. Construction of recreation facilities would also affect a small acreage (about 3-8 acres) of jurisdictional wetlands on the habitat islands.

Additional jurisdictional waters would be affected by the proposed project on the margins of Delta channels along the island perimeters where siphons, pump stations, and recreation facility boat docks would be constructed. Each siphon station would extend approximately 50 feet into a Delta channel along approximately 900 feet of an island perimeter, affecting approximately 0.9 acre of open water. Each proposed pump station would extend 65 feet into the adjacent channel along 1,000 or 1,250 feet of the island perimeter (the distance depending on the number of pump units). A pump station would therefore affect approximately 1.3-1.6 acres of open water. Each of the proposed recreation facility small-boat docks outside the perimeter levees would extend approximately 30 feet into the adjacent channel along approximately 400 feet of the channel edge, affecting about 0.3 acre of channel area.

Under the proposed project, four new siphon stations and two new pump stations would be constructed on the reservoir islands. A maximum of 38 recreation facilities would be constructed on the reservoir and habitat islands. The total amount of jurisdictional waters in adjacent channels affected by these facilities would be approximately 18 acres.

Jurisdictional Wetlands Mitigation of the DW Project

As stated in the beginning of this section, Bouldin Island and Holland Tract would be managed for wetlands and wildlife habitat. Tables 3-4 and 3-5 summarize the DW project impact averages for jurisdictional wetlands and the mitigation ratios and habitat types to be provided by the DW project.

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Table 3-1. Estimated Mean Monthly Diversions and Discharges under DW Project Alternatives 1 and 2 (TAF)

	October	November	December	January	February	March	April	May	June	July	August	September	Annual
Diversions													
Alt. 1	39	41	31	42	24	13	1	2	1	3	1	22	222
Alt. 2	39	41	31	40	24	14	5	2	1	3	1	22	225
No-Project Alternative	2	0	3	3	3	0	0	3	13	16	12	6	60
Existing conditions	1	0	1.5	1.5	1.5	0	0	1.5	6.5	8	6	3	30
Discharges													
Alt. 1	0	1	13	2	10	5	12	16	8	56	49	18	188
Alt. 2	0	1	11	3	37	27	5	17	46	30	18	5	202

Notes: Values for Alternatives 1 and 2 are derived from simulations of DW project diversions to reservoir storage based on the historical hydrologic record for 1922-1991 and assuming current Delta standards.

Values for the No-Project Alternative represent average combined diversions for irrigation and salt leaching estimated for intensified agricultural use of the DW project islands.

The annual simulated patterns of DW project operations vary widely from these average values.

Annual values may not total correctly because of rounding.

Table 3-2. Section 404 Habitat Type Classifications for the DW Project Islands

Habitat Group	Code	Description	Comments	Dominant or Typical Plant Species
Riparian	R-1	Cottonwood-willow woodland	Cottonwood and willow trees	Fremont cottonwood, red willow, yellow willow
	R-2	Great Valley willow scrub	Willow shrubs and trees	Red willow, yellow willow, sandbar willow, Goodding's willow
Marsh	M-1	Freshwater marsh	Inside islands	Cattail, bulrush, yellow nutsedge, pondweed, buttonbush
	M-3	Exotic marsh	Dense upland and wetland weeds (sometimes dry in summer)	Annual smartweed, peppergrass, amaranth, wild radish, nettles, cocklebur
Open water	O-2	Ponds - all year	Permanent water	Water hyacinth, water primrose, azolla

Source: Jones & Stokes Associates 1988.

Table 3-3. Summary of the Effects of the Proposed Project on Section 404 Jurisdictional Wetlands

Artificial Wetland Habitat Type	Preproject Habitat Acres					Acres of Habitat Affected by the Proposed Project (% of Total)				
	Bacon Island	Webb Tract	Bouldin Island	Holland Tract	All Islands	Bacon Island	Webb Tract	Bouldin Island	Holland Tract	All Islands
Riparian cottonwood-willow woodland	0.0	47.5	6.9	67.7	122.1	0.0 (100%)	47.7 (100%)	0.0 (0%)	0.0 (0%)	47.3 (39%)
Riparian willow scrub	2.2	56.2	7.9	14./3	80.8	2.2 (100%)	56.2 (100%)	0.0 (0%)	2.4 (17%)	60.8 (75%)
Freshwater perennial marsh	1.0	24.7	16.5	13.9	56.1	1.0 (100%)	24.7 (100%)	0.8 (5%)	0.7 (5%)	27.2 (48%)
Exotic marsh	2.0	66.9	65.3	12.9	147.1	2.0 (100%)	66.9 (100%)	65.3 (100%)	12.9 (100%)	147.1 (100%)
Permanent pond	0.8	97.1	0.0	13.2	111.1	0.8 (100%)	97.1 (100%)	0.0 (0%)	0.0 (0%)	97.9 (88%)
Canals and ditches	17.8	19.7	35.3	21.8	94.6	17.8 (100%)	19.7 (100%)	0.0 (0%)	0.0 (0%)	37.5 (40%)
Grain and seed crops	0.0	2.6	0.0	0.0	2.6	0.0 (100%)	2.6 (100%)	0.0 (0%)	0.0 (0%)	2.6 (100%)
Annual grassland	0.0	17.0	93.1	0.3	110.4	0.0 (100%)	17.0 (100%)	0.0 (0%)	0.0 (0%)	17.0 (15%)
Exotic perennial grassland	0.0	16.6	0.0	0.0	16.6	0.0 (100%)	16.6 (100%)	0.0 (0%)	0.0 (0%)	16.6 (100%)
Unvegetated disturbed areas	0.0	21.3	0.0	0.0	21.3	0.0 (100%)	21.3 (100%)	0.0 (0%)	0.0 (0%)	21.3 (100%)
Total	24.0	369.6	225.0	144.1	762.7					

Table 3-4. Summary of Section 404 Jurisdictional Wetlands Mitigation

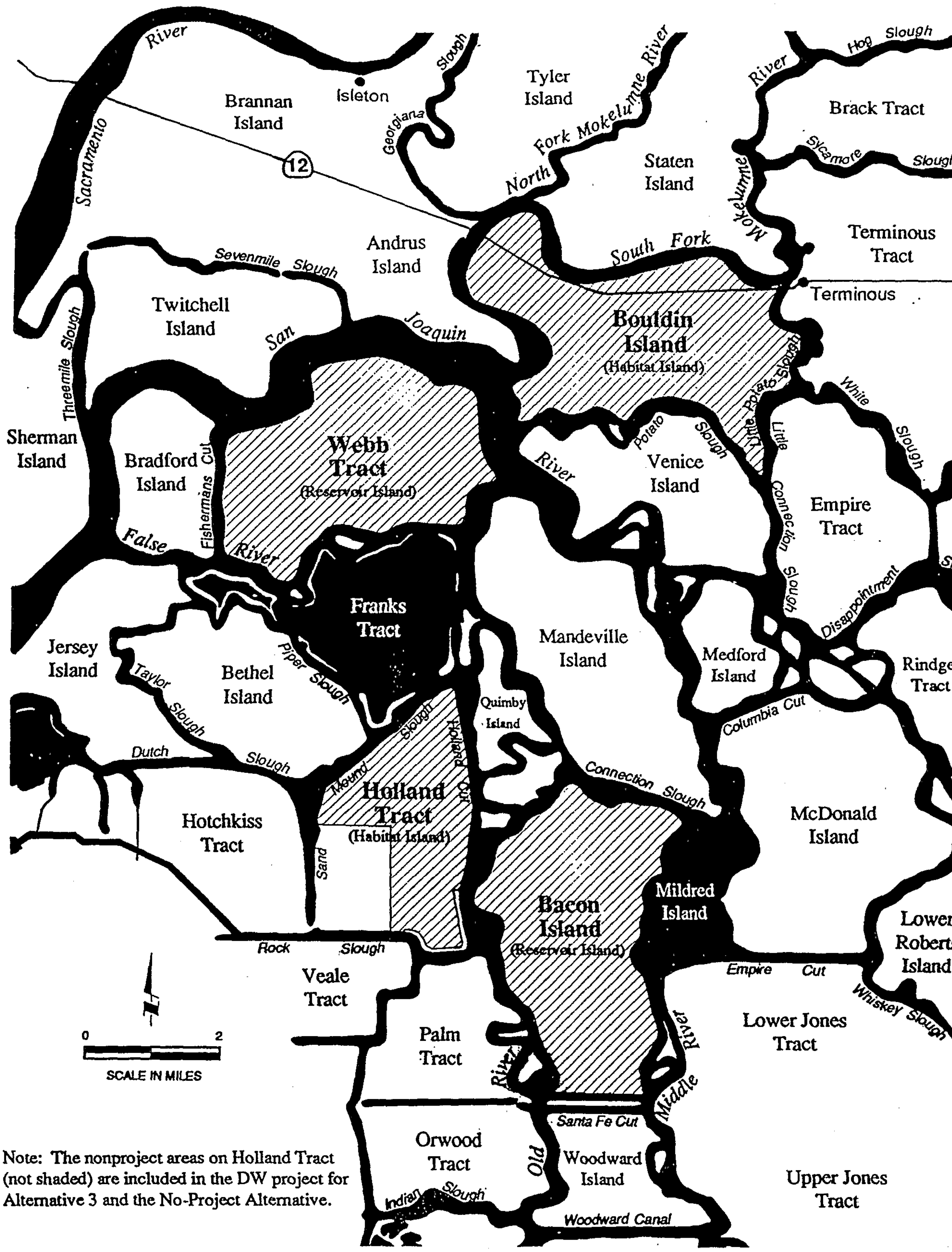
Project Impact	Impact Acreage	Method and Ratios	Migitation Acreage Required	Mitigation Acreage Provided on Habitat Islands	Actual Mitigation Ratio	Habitat Island Mitigation Habitats
Loss of cottonwood-willow woodland habitat	47.5	Replace affected acreage with in-kind habitat at a 3:1 ratio (from guidelines formulated by the Habitat Management Plan [HMP] team)	142.5	143.1	3:1	1. Riparian woodland
Loss of willow scrub habitat	61.0	Replace affected acreage with in-kind habitat at a 2:1 ratio (from guidelines formulated by the HMP team)	122.0	122.0	2:1	1. Willow scrub
Loss of freshwater marsh	27.2	Replace affected acreage with in-kind habitat at a 2:1 ratio (from guidelines formulated by the HMP team)	54.4	353.1	13:1	1. Emergent marsh
Loss of exotic marsh	160.8	Replace affected acreage with out-of-kind habitat at a 2:1 ratio (from guidelines formulated by the HMP team)	321.6	3,895	24:1	1. Seasonal managed wetland 2. Mixed agriculture/seasonal wetland 3. Seasonal pond
Loss of permanent pond	97.9	Replace affected acreage with in-kind habitat at a 1:1 ratio (from guidelines formulated by the HMP team)	97.9	111.0	1.1:1	1. Permanent lake
Loss of Section 404 jurisdictional canals and ditches, grain and seed crops, annual grasslands, exotic perennial grasslands, and unvegetated disturbed areas	57.5	Manage similar habitats to be established on habitat islands to provide greater wildlife values than are associated with these habitats under preproject conditions	N/A[a]	8,348[b]		1. Mixed agriculture/seasonal wetland 2. Corn/wheat fields 3. Small grain fields 4. Herbaceous upland 5. Seasonal managed wetland 6. Canals and ditches

[a] N/A = not applicable.

[b] Does not include the acreage of canals and ditches that would be established on habitat islands.

Table 3-5. Acres of Jurisdictional Wetland Mitigation Habitats to Be Developed on the Habitat Islands

Replacement Mitigation Habitat	Holland Tract Total Acres	Bouldin Island Total Acres	Habitat Island Total Acres
Corn/wheat	955	1,629	2,584
Small grains	152	106	258
Managed agriculture/seasonal wetland	631	1,014	1,645
Seasonal managed wetland	393	1,723	2,116
Emergent marsh	194	208	402
Cottonwood-willow woodland and willow scrub	217	170	387
Permanent lake	33	111	144
Herbaceous upland	253	479	732
Canals and ditches	10	70	80
Total	2,838	5,510	8,348



Note: The nonproject areas on Holland Tract (not shaded) are included in the DW project for Alternative 3 and the No-Project Alternative.

Source: Adapted from California Department of Water Resources 1993.

Figure 3-1.
DW Project Islands

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

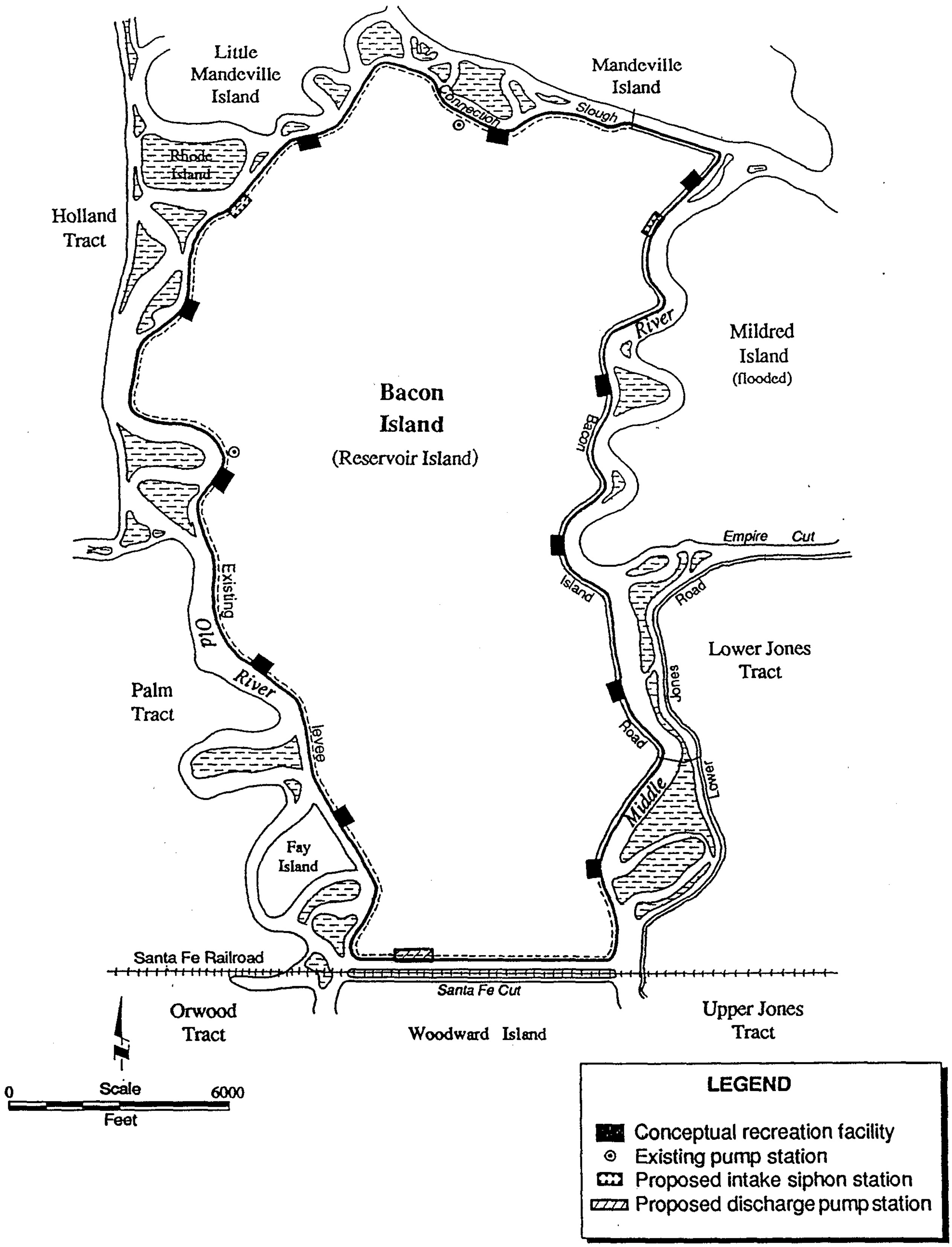


Figure 3-2.
DW Project Facilities for Bacon Island under Alternatives 1 and 2

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

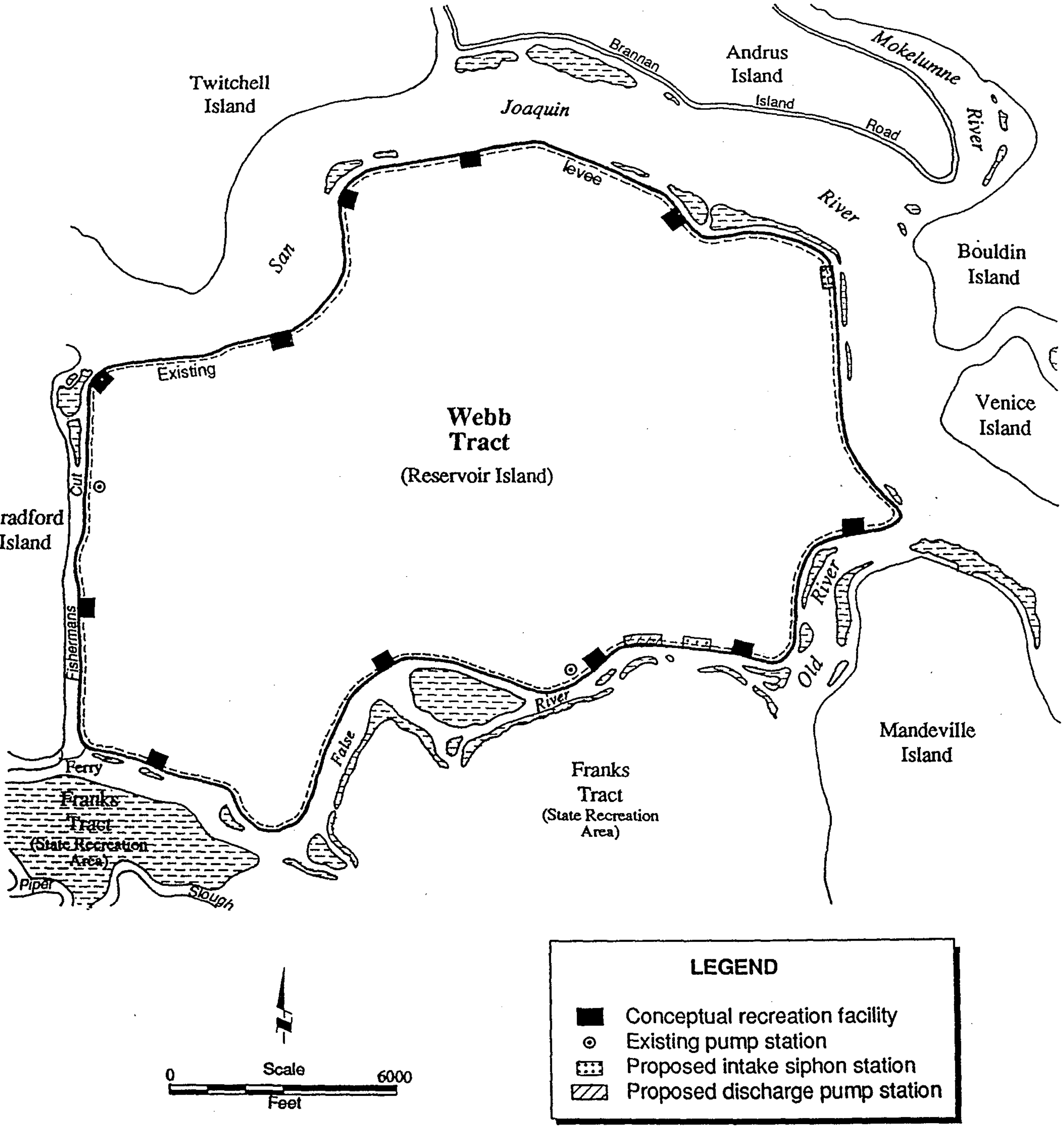


Figure 3-3.
DW Project Facilities for Webb Tract under Alternatives 1 and 2

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

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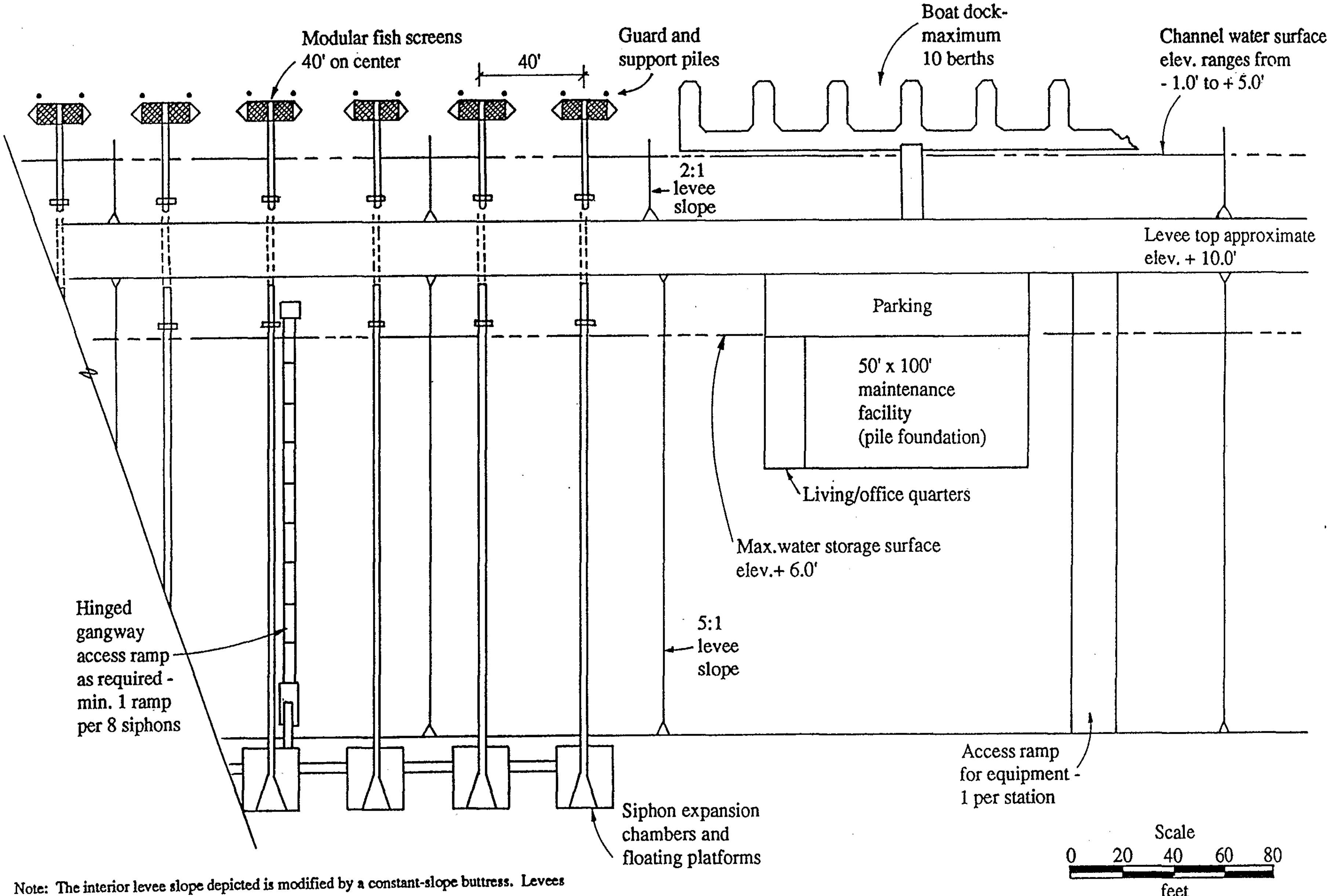
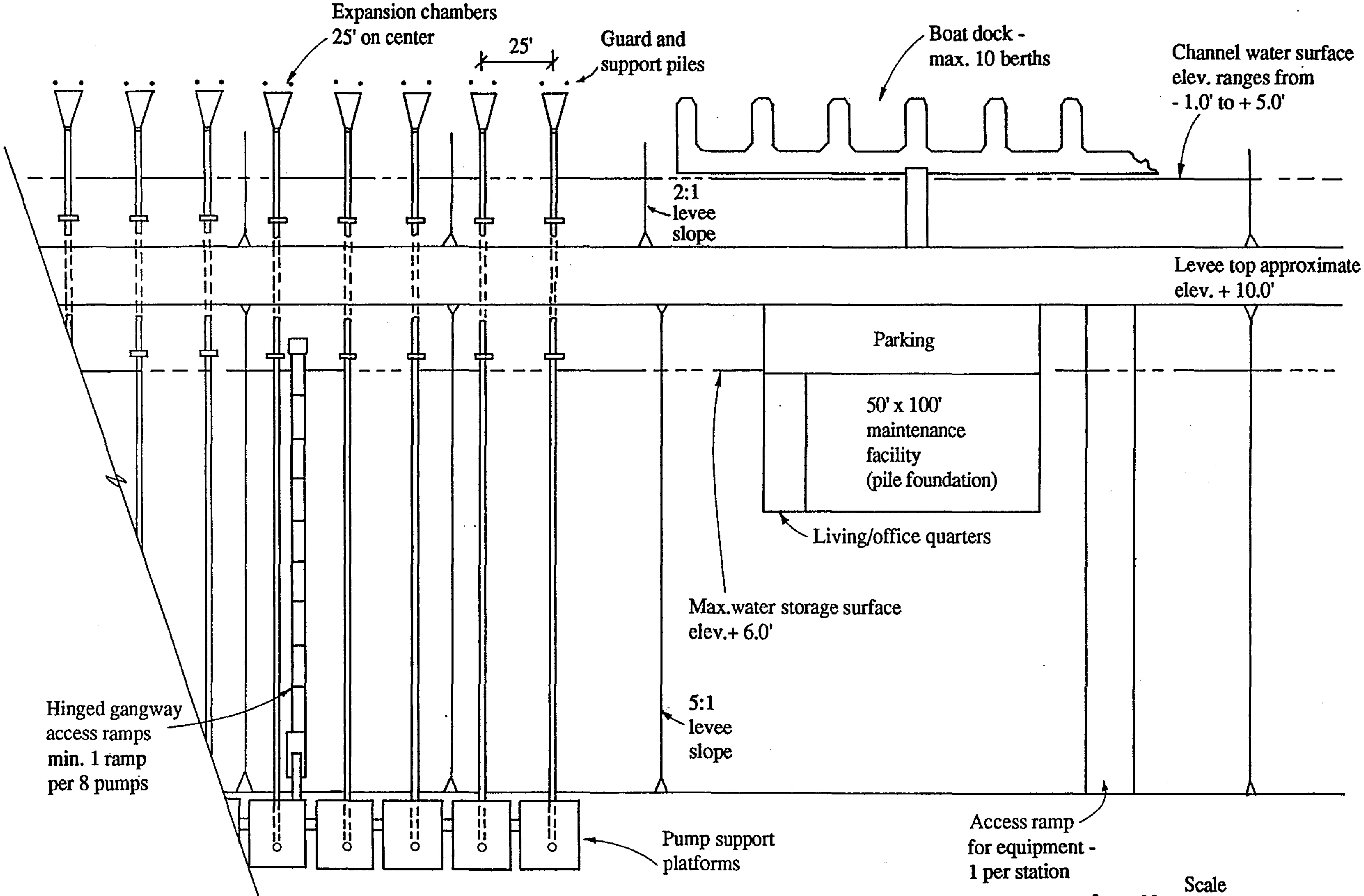


Note: The interior levee slope depicted is modified by a constant-slope buttress. Levees may also be modified by a broken-slope buttress.

Figure 3-4.
Siphon Station Plan View

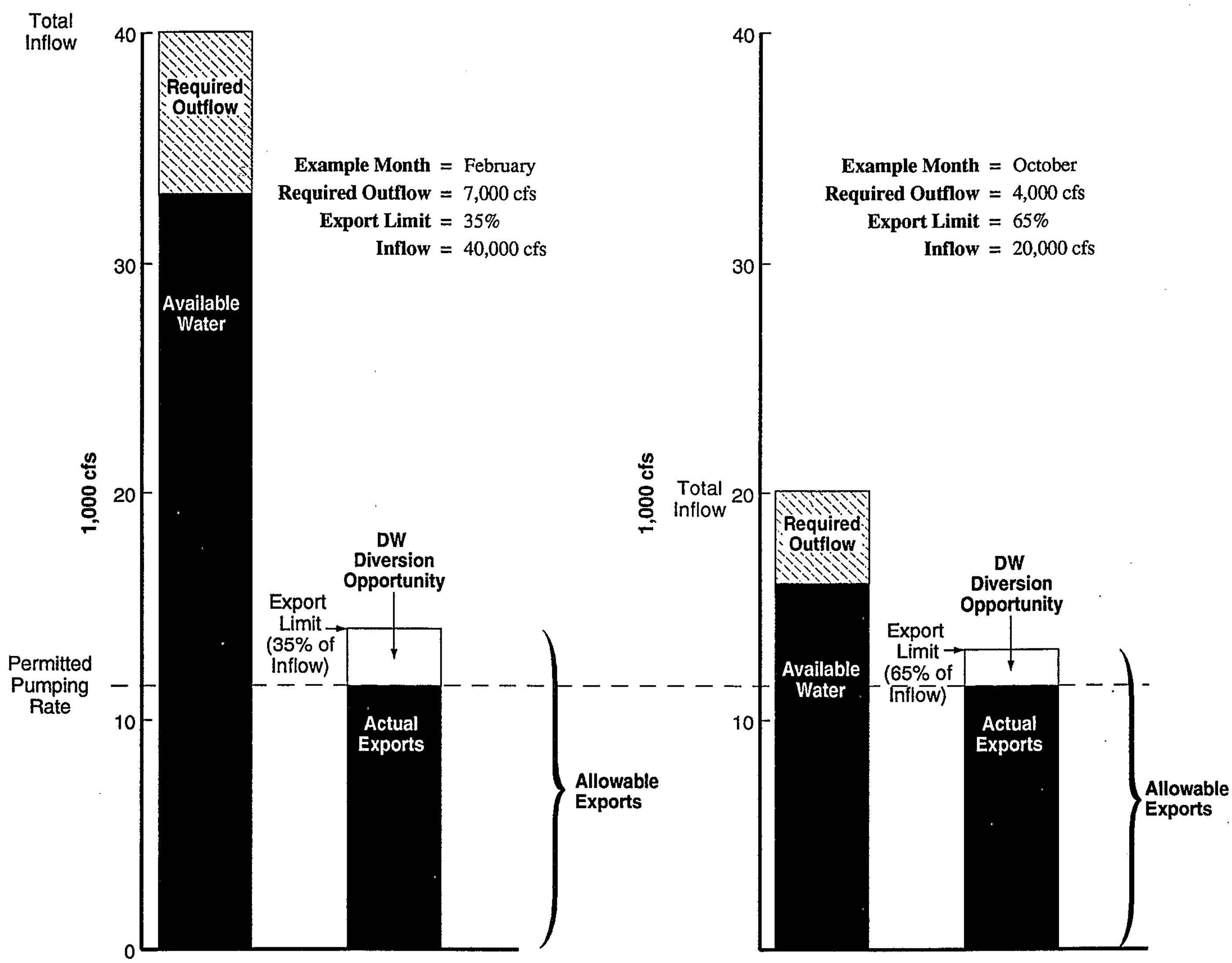
DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates



Note: The interior levee slope depicted is modified by a constant-slope buttress. Levees may also be modified by a broken-slope buttress.

Figure 3-5.
Pump Station Plan View

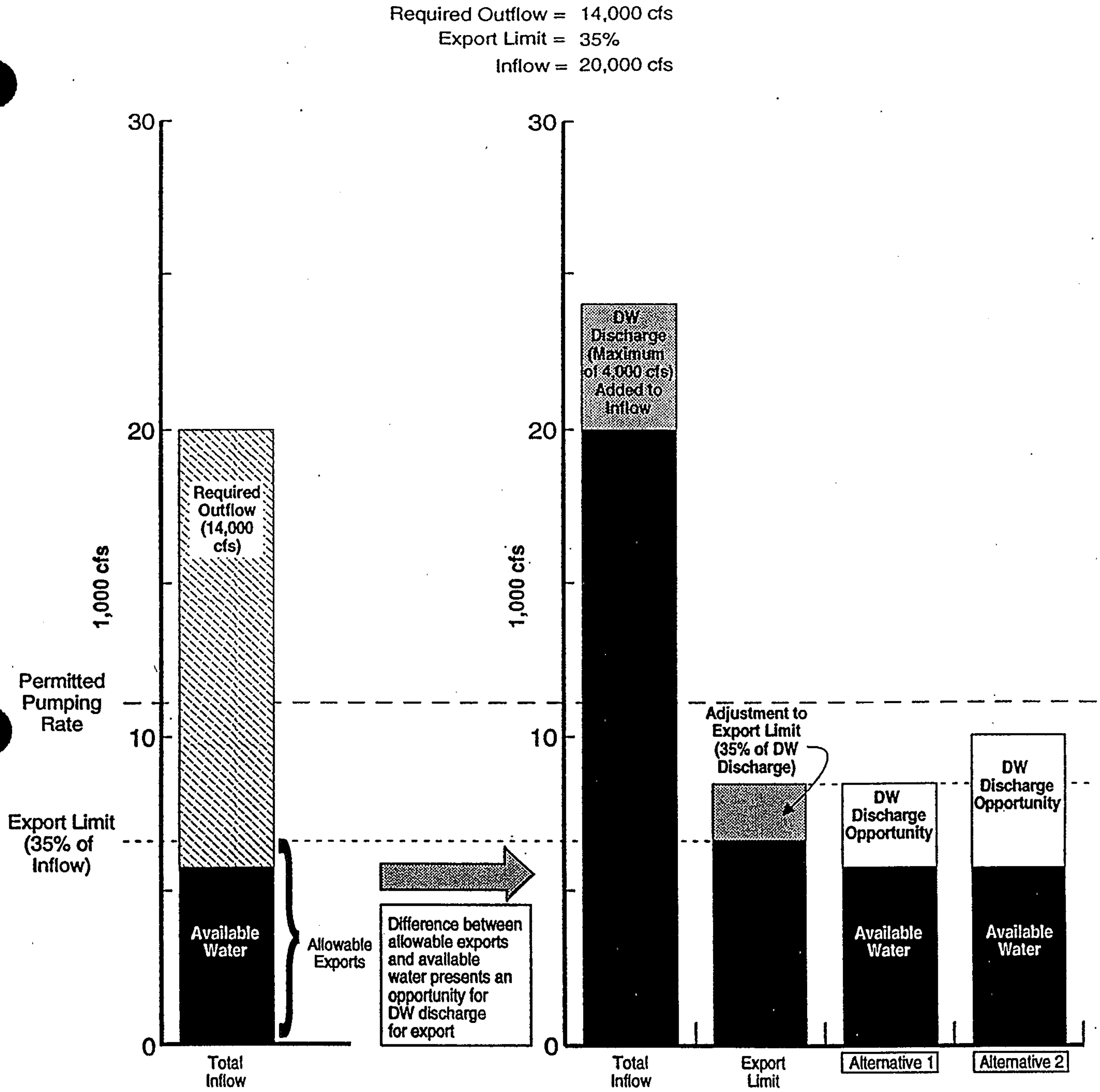
DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates



DW diversion opportunity = export limit - actual exports (actual exports limited by permitted pumping rate)

Figure 3-6.
Examples of DW Diversion Opportunities

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates



Alternative 1: DW discharge subject to the (adjusted) export limit

Alternative 2: DW discharge not subject to the export limit. The amount of DW discharge added to inflow and to the export limit are not relevant to this alternative. DW discharges for export would be allowed up to the permitted pumping rate as long as outflow requirements are met.

Figure 3-7.
Examples of DW Discharge Export Opportunities

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

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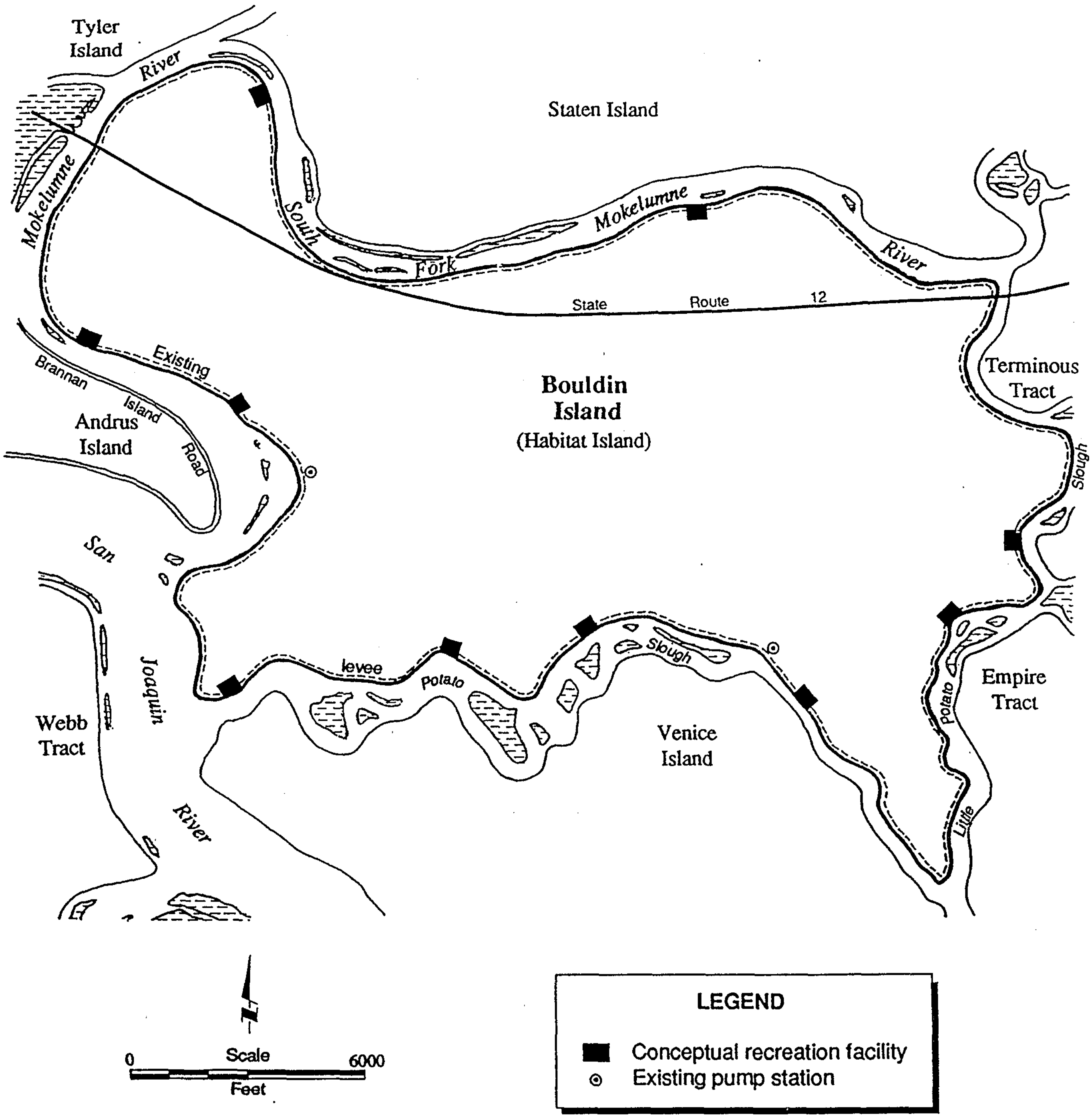


Figure 3-8.
DW Project Facilities for Bouldin Island under Alternatives 1 and 2

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

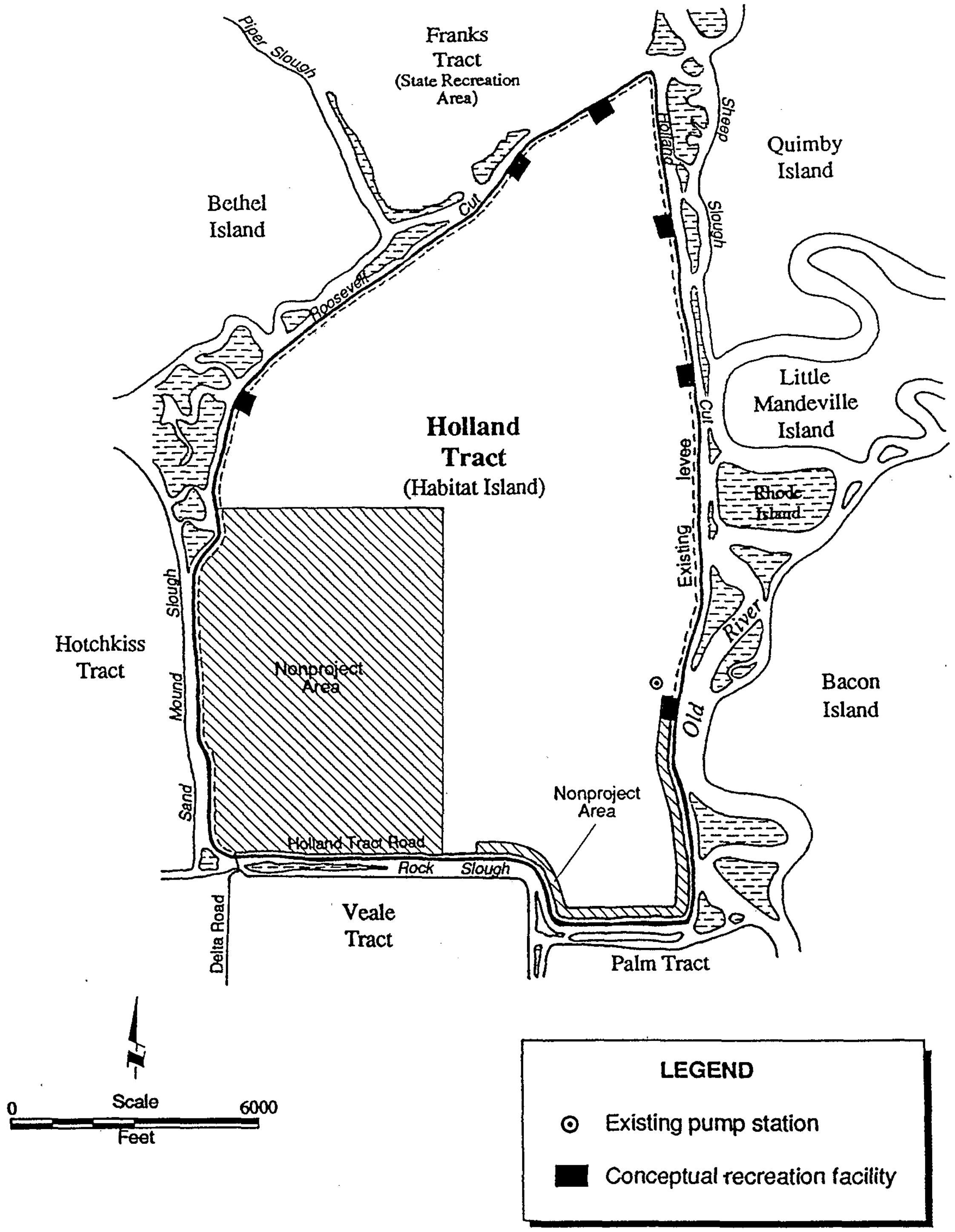
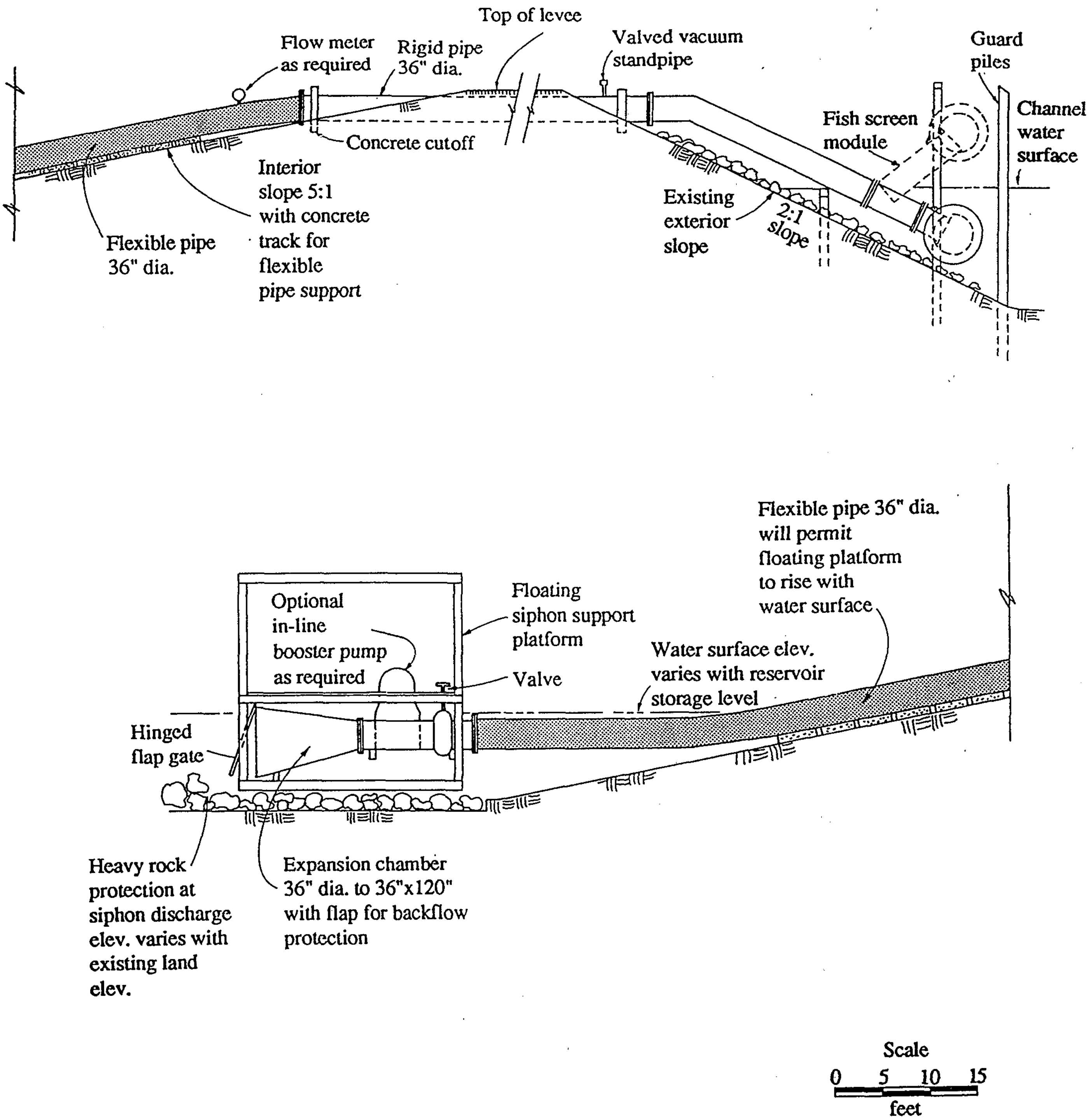


Figure 3-9.
DW Project Facilities for Holland Tract under Alternatives 1 and 2

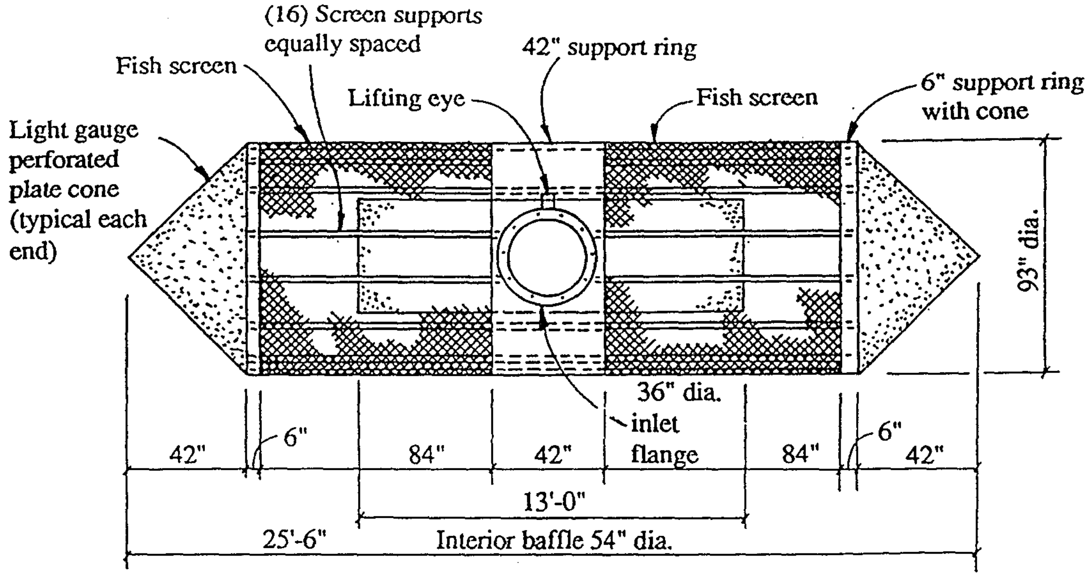
DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates



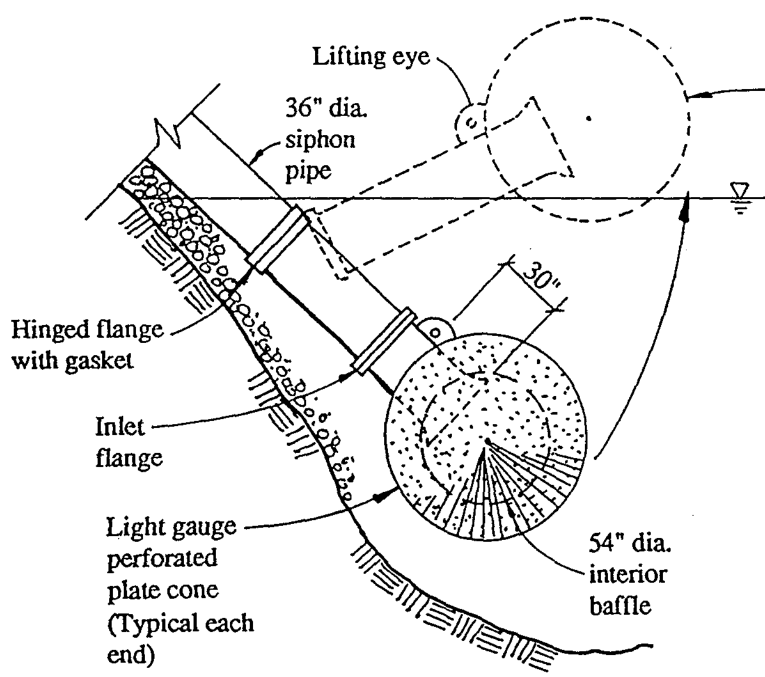
Note: The interior levee slope depicted is modified by a constant-slope buttress. Levees may also be modified by a broken-slope buttress.

Figure 3-10.
Conceptual Siphon Unit

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates



Front view



Side view

Fish screen notes:

1. Use 7x0.035 woven wire mesh 304 stainless steel screen
2. Use 5/32 perforated plate 304 stainless steel for end cones
3. Screens are lifted out of water and brush-cleaned when in use
4. Screens are removed from water when not in use
5. Interior baffle, 16 gauge stainless steel with 1" dia. perforations, 25% open

Figure 3-11.
Fish Screen Design

DELTA WETLANDS PROJECT
Prepared by: Jones & Stokes Associates

Section 4. Evaluation Criteria for Practicability Analysis of Alternatives

EPA's guidelines for implementing Section 404(b)(1) require that project applicants consider alternatives that could result in avoidance of impacts on waters of the United States:

> No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences (40 CFR Sec. 230.10[a]).

Alternatives to a project must be capable of achieving the proposed project's basic purpose and each alternative must be practicable (40 CFR 230.10[a][2]):

> An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded or managed in order to fulfill the basic purpose of the proposed activity may be considered.

Based on these requirements, this alternatives analysis uses standardized evaluation criteria to analyze the practicability of alternatives to the proposed project. The alternatives were analyzed based on their ability to satisfy the proposed project's basic purpose within the limits of the standardized evaluation criteria. Section 5 applies these evaluation criteria to the nonstructural alternatives and offsite and onsite structural alternatives.

SCREENING METHODOLOGY AND CRITERIA

General Methodology of Alternatives Analysis

The study area for an alternatives analysis should not be so small as to eliminate reasonable alternatives to the proposed project but should not be so broad as to include an unlimited number of alternatives. The study area for this alternatives analysis was limited to California. The range of alternatives for this alternatives analysis was not limited, however, to facilities for water storage in the Delta. This analysis also considered nonstructural alternatives that do not require construction of new facilities.

First-Stage Evaluation

The alternatives were analyzed in three stages. In the first stage, the alternatives were analyzed to determine those that would not reasonably meet the overall project purpose, separately or in combination with other alternatives. The ability of each alternative to satisfy the project purpose was considered in conjunction with environmental impacts and availability of the alternative, but only on a general or reconnaissance level. The first-stage evaluation does not strictly define practicable alternatives, but only attempts to eliminate those alternatives that could not meet a remedial level of screening.

Second-Stage Evaluation

In the second stage, the alternatives carried forward from the first-stage evaluation were analyzed in greater detail. Each screening criterion was rigorously applied to each alternative to identify practicable alternatives to achieve the overall project purpose. The second-stage evaluation considered information on the alternative's environmental impacts but did not analyze the alternatives on the same level of detail as the EIR/EIS. This stage analyzed the alternative's ability to satisfy the project purpose in light of the alternative's availability and feasibility with regard to logistical, technological, and cost considerations. The second-stage evaluation defined those potentially practicable alternatives that required detailed study for comparison of aquatic ecosystem and other environmental impacts.

Third-Stage Evaluation

The third stage consisted of detailed analysis that is a part of the environmental impact evaluations necessary to complete the EIR/EIS. Detailed environmental impact assessments focusing on environmental issues, including aquatic ecosystem impacts, were conducted on specific alternatives.

Development of Screening Criteria

This section identifies the types of supporting information needed to evaluate alternatives to the proposed project.

Ability to Satisfy the Project Purpose

This criterion was used to analyze each alternative's capability to increase the long-term supply of high-quality water in the Delta to be sold for export south of the Delta and/or Delta outflow to San Francisco Bay. An alternative was not excluded from consideration as a practicable alternative because it would provide water only for export or only for outflow. Alternatives were considered unable to meet the project purpose if they would not be able to supply water for export south of the Delta or for outflow to San Francisco Bay. Alternatives that would only achieve half of the intended project purpose were considered in combination with other alternatives to fully achieve the project purpose and were not removed from consideration as practicable alternatives.

An alternative had to be reasonably defined and have an available project description for its ability to meet the project purpose to be determined. Those alternatives that may, in theory, meet the project purpose but that were not described or readily definable were eliminated from consideration as practicable alternatives.

Availability to the Project Proponent

This criterion was used to analyze each alternative's availability to the project applicant. The availability of an alternative was determined as of the time of initial project planning (i.e., 1987). A potential alternative site must have been available to the applicant. Availability is based on whether the alternative site was owned, used, or managed by the applicant or was capable of being owned, used, or managed by the applicant. According to EPA's guidelines, a practicable alternative site could be "an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded or managed in order to fulfill the basic purpose of the proposed activity" (40 CFR Sec. 230.10[a][2]).

The project applicant for the DW project is Delta Wetlands Properties, a private proponent not associated with a public entity. Because the proponent is not a public entity, it does not have the power of eminent domain nor does it have public funding available to it. This alternatives analysis identified when the alternative is unavailable to the project proponent. For preparation of this alternatives analysis, however, an alternative was not eliminated from consideration as a practicable alternative solely because it is unavailable to the project applicant.

Wetland and Other Environmental Impacts

As mentioned above, each alternative to the DW project must be evaluated to determine whether it would cause less adverse environmental impacts than the proposed project would cause. Therefore, when considering alternatives to the proposed project, this alternatives analysis addressed potential impacts on the aquatic ecosystem, including special aquatic sites, relative to Delta islands or the entire Delta aquatic ecosystem.

This alternatives analysis considered whether an alternative could achieve complete avoidance of all discharge into wetlands. Where it could be shown that an alternative would not avoid special aquatic sites or would not have less of a net overall impact on the aquatic ecosystem, the alternative was eliminated from further consideration as a practicable alternative to the proposed project. This alternatives analysis discusses other environmental impacts that may be associated with an alternative.

Financial Limitations

The DW project was designed and formulated from 1985 to 1987. During that period, DW studied the potential market for sale of water from its project. At that time, DW determined that DWR, which operates the SWP, was the customer most likely to purchase water from the project. DW made this determination against the following background.

The CVP, operated by Reclamation, and the SWP, operated by DWR, are the largest and most complex water systems in the world. Economic growth has occurred in California as a result of operation of these two projects. Additionally, these two projects have created some substantial environmental problems in the Delta and beyond, which need to be corrected.

Soon after the SWP began its first stage of operation in the early 1970s, DWR proposed the construction of the Peripheral Canal (see Summary of Draft Environmental Impact Report, Peripheral Canal Project [DWR 1974]). The stated purpose of the Peripheral Canal was to convey water across the Delta to the aqueducts of the SWP and the CVP without undue reduction in supply or deterioration in quality, to correct certain adverse environmental conditions in the Delta, and to facilitate water management in the Delta (DWR 1974). In 1982, the Peripheral Canal project was defeated in a voter referendum.

As Delta exports increased over time, fish mortality associated with Delta salinity intrusion and reverse flow increased. Following the defeat of the Peripheral Canal project, DWR continued to examine other projects to improve the yield of the SWP (see Alternatives for Delta Water Transfer [DWR 1983] and Alternative Plans for Offstream Storage South of the Delta [DWR 1984]). In 1987, DWR, in California Water: Looking to the Future (Bulletin 160-87), stated that the SWP "has reached the point where current requests for water by the project's contractors exceed dependable supplies . . . . [T]he *existing* SWP facilities would have a deficit in present dependable supplies in 2010 of some 1.3 million acre-feet" (DWR 1987).

DWR (1987) also listed the following planned additions to the SWP for improving water supply reliability (the 1987 estimate of the capacity of each facility is listed in parentheses):

- Delta pumping plant additional units (60 TAF/yr);
- interim CVP supply purchase (250-500 TAF/yr);
- Kern Water Bank (160 TAF/yr);
- Los Banos Grandes Reservoir (214 TAF/yr);
- south Delta facilities (±220 TAF/yr); and
- north Delta facilities (±220 TAF/yr).

However, even if these supply additions were made, DWR estimated that "[a] need for dependable supplies amounting to as much as 0.4 million acre-feet in a given year would remain . . . It should be emphasized that this would not be a chronic shortage, but a shortage could occur in dry years." (DWR 1987.)

Because of this history, DW understood that DWR would likely have a need for water over and above the amounts that could be supplied by these additions. However, because of the substantial risk involved in developing a private water project in California, it would have been imprudent for DW to rely solely on DWR's unmet need projections. Therefore, DW sought to formulate and design a project that would both fill DWR's unmet need and serve as an alternative to some of DWR's planned additions. Thus, the DW project would not preclude the development of DWR's planned additions, but could serve as an alternative.

Because the majority of the projects DWR was developing during the DW project formation period were within the average annual yield range of 160-250 TAF, and because a project of that size would be financially feasible for DW, DW initially designed its project with a reservoir capacity of between 200 TAF and 300 TAF to accommodate fluctuations in yield depending on the water availability in any given year. The conversion from average annual yield to reservoir size was accomplished by division of average annual yield by 80%, the expected occurrence of filling (160 TAF/yr ÷ 0.80 = 200 TAF of storage capacity).

Additionally, this decision was based on various informal conversations during that time with representatives of DWR. Those conversations indicated that DWR would be significantly less interested in a small private water project (i.e., 100 TAF or less) and that a larger project would be of more value to DWR. This information came as no surprise to DW because a larger water project would be operationally and administratively simpler to integrate into the complex SWP system than would a few smaller projects.

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Based on the foregoing, DW formulated and designed a project with a minimum reservoir capacity of approximately 200 TAF.

Financial limitations for a given alternative were based on DW's considerations, described above, in developing its proposal to sell water stored on Delta islands. DW's financial considerations encompass a large complex of cost factors, including land, financing, design, environmental permitting, mitigation, construction, and operation. When integrated, these cost factors can be represented by a minimum project size for financial feasibility. For purposes of this alternatives analysis, an alternative was considered to be financially feasible when it would produce a long-term average water supply yield of 160 TAF/yr and when it would provide a minimum water storage capacity of 200 TAF.

Section 5. Practicability Analysis of Alternatives

DESCRIPTION OF ALTERNATIVES

The alternatives that were considered were not limited to typical water storage facilities in the Delta and included nonstructural and structural projects. Nonstructural alternatives are those that do not require construction of new major facilities. Nonstructural alternatives considered for this analysis were a no-project alternative, an alternative for reoperation of the SWP and the CVP, a water conservation alternative, and a water transfers alternative.

Structural alternatives are those that require construction of new facilities offsite or onsite. Offsite structural alternatives considered for this analysis were a non-Delta (upstream and side-stream) water storage alternative and an alternative for water storage on other Delta islands. Onsite structural alternatives considered for this analysis were:

- Alternative 1 consists of operation of two reservoir islands and two habitat islands and implementation of an HMP. Under Alternative 1, DW discharges would be subject to "percent of inflow" export limits specified in the 1995 WQCP.
- Alternative 2 consists of operation of two reservoir islands and two habitat islands and implementation of an HMP. Under Alternative 2, DW discharges for export would not be subject to strict interpretation of the 1995 WQCP "percent of inflow" export limits.
- Alternative 3 consists of operation of four reservoir islands, with limited compensation habitat provided in the North Bouldin Habitat Area (NBHA) on Bouldin Island. Under Alternative 3, discharges for export would not be subject to strict interpretation of the 1995 WQCP "percent of inflow" export limits.
- The No-Project Alternative consists of intensified agricultural production on all four DW project islands.

Alternatives 1, 2, and 3 are described below under "Onsite Structural Alternatives". Alternatives 1 and 2 represent alternative operations of the proposed project and are described in detail in Section 3, "Proposed Project Features".

NONSTRUCTURAL ALTERNATIVES

No-Project Alternative

The No-Project Alternative represents the activities that would be continued or implemented if Corps permit applications under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act or SWRCB water right applications for the DW project are denied. No form of the proposed DW project would be feasible without inundation of island bottoms by stored water and without deposit of dredged or fill material for levee improvements. If the Corps denies the DW permit applications, DW could not implement a project that meets the project purpose. Instead, DW would implement intensive agricultural operations on the four project islands or sell the property to another entity that would probably implement intensive agricultural operations.

The No-Project Alternative would be limited to farming activities that could be implemented without a Section 404 permit or water right approval. Under Section 404(f)(1) of the Clean Water Act, normal farming activities, such as plowing, seeding, cultivating, and maintaining ditches, are exempt from Section 404 permit requirements if part of an existing operation. Additional farming activities that are not part of an existing operation will not be under Section 404 regulation as long as they do not involve the discharge of dredged or fill material, including surface materials redistributed by blading or grading to fill wetland areas. The No-Project Alternative would entail implementing more efficient drainage and weed management practices on Holland and Webb Tracts and shifting some crop types on Bacon and Bouldin Islands.

The No-Project Alternative would not satisfy the project purpose. Under this alternative, intensified agricultural operations would be conducted on the four project islands. This activity would decrease the supply of high-quality water in the Delta. This alternative would not contribute to meeting the existing and future needs for high-quality water in the Delta for export and outflow.

The No-Project Alternative was eliminated from further evaluation as a practicable alternative to the proposed project because it would decrease the availability of high-quality water in the Delta for sale for export south of the Delta or as outflow to San Francisco Bay. However, for purposes of satisfying the requirements of NEPA and CEQA and for comparing alternatives, the No-Project Alternative is analyzed in the EIR/EIS, as discussed below under "Alternatives Analyzed in this Biological Assessment".

Reoperation of the CVP and the SWP

Under this alternative, DWR and Reclamation would further integrate and consolidate operations of the CVP and the SWP. Currently, the federal and state water projects operate their systems under different sets of rules. Integrating the CVP and the SWP would facilitate greater operational flexibility of the two systems and could facilitate improved water management throughout California's water system. A more efficient water system could result from better coordination of groundwater and surface water supplies and deliveries and easier implementation of water conservation techniques, market-based water transfers, and groundwater management.

Reoperation of the CVP and the SWP, as described above, would require combined management of the CVP and the SWP to increase the operational flexibility of the two projects and therefore result in a more efficient water storage and delivery system. This alternative could increase the supply of high-quality water in the Delta for sale for export south of the Delta or as Delta outflow to San Francisco Bay.

CVP facilities are operated for several distinct, and at times conflicting, purposes, including water supply for agricultural and urban uses, hydroelectric power generation, water quality maintenance, flood control, navigation, recreation, and fish and wildlife benefits. Many institutional, legal, and economic considerations are associated with the transfer of the CVP.

This alternative has not been sufficiently defined to determine whether it could achieve the project purpose of increasing the supply of high-quality water in the Delta. It is presently impossible to estimate how much the combined management of the CVP and SWP would contribute to increasing the quantity of high-quality water in the Delta.

Reoperation of the CVP and the SWP is not an available alternative to the project proponent. No role exists for a private participant in the management of an integrated CVP and SWP system. Financial implications of the reoperation of the CVP and the SWP are uncertain. The alternative could require substantial financial investments to evaluate, negotiate, plan, and implement CVP transfer and coordinated management of the two systems.

For the reasons stated above, reoperation of the CVP and the SWP was eliminated from further evaluation as a practicable alternative.

Water Conservation Alternative

Under this alternative, an entity (presumably governmental) would implement a water conservation program that would result in increased supplies of water in the Delta. Conservation measures for residential developments include retrofitting existing residences and constructing new developments with low-flow fixtures and appliances, relandscaping existing developments and landscaping new developments with drought-tolerant plants, and installing drip irrigation systems. Conservation measures for commercial and industrial uses include landscaping with xerophytic plants to reduce irrigation to a minimum, retrofitting existing structures, constructing new developments with low-flow fixtures, recycling water, and repairing leaks. Conservation measures for agriculture include furrow irrigation techniques, irrigation management, and irrigation system assessment.

DWR (1994) estimated that urban and agricultural water conservation programs might achieve 3 MAF of demand reduction statewide by 2020. This demand reduction was accounted for in the DWR (1994) projections for long-term California water demand. It is not possible to estimate the extent to which a reduction in California water demand would reduce demand in the Delta watershed, or how a reduction in demand in the Delta might contribute to increased Delta water supply. Therefore, the water conservation alternative cannot be defined sufficiently to support the conclusion that it would be able to satisfy the project purpose.

Water conservation, on a very small scale, is available to the project applicant. DW could implement water conservation efforts for intensified agricultural uses on its four Delta islands, but these efforts would not generate a measurable supply of water for sale for export or outflow. Conservation on a scale broad enough to have the potential to supply a minimum amount of water would require public, institutional, local agency, private industry, and agricultural community participation and would therefore be unavailable as a project alternative to DW.

For the reasons stated above, the water conservation alternative was eliminated from further evaluation as a practicable alternative.

Water Transfers Alternative

The water transfers alternative would consist of voluntary, market-based temporary and long-term water transfers directly using the Delta. The voluntary transfer of water has the potential to be an important means of achieving better water management in California. The California Legislature has declared that the established policy of the state is to facilitate voluntary water transfers and has directed DWR, SWRCB, and all other state agencies to encourage voluntary water transfers (California Water Code Sections 109 and 475).

Voluntary, market-based temporary and long-term water transfers directly using the Delta could increase the supply of high-quality water in the Delta for sale for export and/or outflow. Although DW could act as a type of broker for potential suppliers and buyers of market water, the feasibility of this role is highly speculative. The role DW would play in this alternative is not defined clearly enough to allow proper evaluation of the financial feasibility of DW being a broker in the water transfer market. A broker may not have a financially feasibly role in the water transfer market if suppliers and buyers contract directly with each other without the aid of a broker.

Water transfers can be short term (1 year or less) or long term. Many short-term water transfers were implemented through the State Drought Water Bank in 1991 and 1992 (DWR 1994). Short-term transfers are typically based on fallowing of irrigable agricultural land for short periods or on temporary shifts of supplies not needed by the seller on an interim basis. Long-term transfers that could increase water supply to the Delta are not sufficiently definable to be considered a practicable alternative to meet the project purpose. Because of the temporary or interim nature of these transfers, they cannot achieve the basic project purpose of long-term increase in Delta water supply.

As stated above, the water transfers alternative was eliminated from further evaluation as a practicable alternative because:

- it would not realistically be available to the project proponent,
- it is not definable as a program of long-term transfers to increase Delta water supply,
- temporary transfers cannot meet the long-term project purpose, and
- the alternative may have limited financial feasibility for DW as a participant.

OFFSITE STRUCTURAL ALTERNATIVES

Non-Delta Water Storage or Conjunctive Use

Non-Delta water storage entails the construction of storage facilities with the capacity to store high-quality water for later use for Delta export or outflow. Such storage facilities could include surface water storage reservoirs or groundwater storage basins. Such facilities also could be operated conjunctively to improve overall supply reliability.

Agencies that are responsible for municipal, regional, state, and federal water systems are presently considering non-Delta options for offstream storage between the Delta and places of use (e.g., Los Banos Grandes Reservoir, Kern Water Bank, Domenigoni Reservoir, and the Los Vaqueros Project) (DWR 1994). These entities are also pursuing several options for conjunctive use of groundwater basins to produce drought-year water supplies (DWR 1994).

Under this alternative, a water storage facility could be constructed and operated to increase the long-term supply of high-quality water in the Delta. Similarly, a conjunctive use program could be developed to increase Delta water supplies in drought years.

Conjunctive use programs require sponsorship and direction by regional water districts that coordinate management of large areas of irrigated farmland and defined groundwater basins in combination with centralized points for surface water diversions. Therefore, a conjunctive use water management program does not appear to be available to the project proponent. Furthermore, a conjunctive use program would not increase Delta water supplies over the long term but could increase Delta inflows in dry years.

As stated above, this alternative was eliminated from further evaluation as a practicable alternative for the following reasons:

- definable options that might be implemented under this alternative by 2020 are not available to the project proponent;

- other options require extensive investigation to determine their financial feasibility or their compatibility with a long-term Delta solution and thus are not currently definable; and

- conjunctive use programs might increase Delta water supplies only in drought years and are not available to the project proponent.

Water Storage on Other Delta Islands

This alternative could include using any number of the islands in the Delta other than DW's Bacon and Bouldin Islands and Holland and Webb Tracts to provide water storage for later sale for export or outflow. The facilities and operations used for this alternative would be the same as those described for Alternatives 1 and 2.

Although this alternative was generally available to the project proponent at the time of initial project planning, specific islands were unavailable and certain factors particular to each Delta island affect the financial feasibility of using an island as a potential site for water storage. Therefore, this alternative was eliminated from evaluation as a practicable alternative.

Sierra Supply Sources

Under Sierra Supply Source alternatives, the DW project would involve securing additional water rights from sources in the Sierras and distributing them to the CVP and SWP. A Sierra supply source could potentially be developed at the following locations:

- Upper American River Basin,
- Upper Feather River Basin,
- Putah Creek Basin,
- Sacramento River Basin,
- Stanislaus River Basin,
- Cosumnes River Basin,
- Mokelumne River Basin,
- Calaveras River Basin,
- Tuolumne River Basin, and
- Southern San Joaquin River Basin.

Water rights for Sierra streams would be difficult to obtain and any rights would probably contain severe restrictions on the rate and timing of diversions. Potential negative impacts on current Sierra water users would be likely, especially during critically dry water years. Attempts by current water right holders to obtain additional Sierra supplies have met with strong opposition from both environmental groups and regulatory agencies. Major, unavoidable environmental impacts from a Sierra supply source would be likely to affect fisheries resources in Sierra source streams. (CCWD 1992).

Because the Sierra supply alternatives would face extremely difficult institutional hurdles and would have severe environmental effects, they were removed from further analysis.

Groundwater Management

Under the Groundwater Management Alternative, DW would secure rights to a quality of water from the Delta, then divert that water and convey it to a groundwater storage basin. The water from the basin would then be pumped out and conveyed back to the Delta to be sold to the CVP and SWP. Groundwater basins that could be used for this purpose include the Livermore Valley Basin and the San Joaquin County Basin.

The use of the Livermore Valley Basin for storing groundwater would entail significant costs and has many technical constraints. The capital cost of this alternative was estimated to be $380 million in 1988 dollars. The technical constraints include problems associated with the siting of facilities, impacts on current users of the groundwater basin and potential overdrafting problems at individual wells. (CCWD 1992).

The use of the San Joaquin County Basin for storing groundwater would also entail significant costs and technical constraints. The capital cost of this alterative was estimated to be $415 million in 1988 dollars. The major technical constraints associated with this alternative are groundwater recharging and jurisdictional constraints. (CCWD 1992).

Because of the costs and the technical constraints involved, both of the alternative groundwater basin alternatives are considered infeasible and were removed from further analysis.

Desalination

Under the Desalination alternative, DW would establish a desalination facility near a source of salt or brackish water and would operate the facility to provide a new source of water. This water would then be sold to the CVP or the SWP. Five desalination processes were considered:

- distillation,
- reverse osmosis,
- electrodialysis or electrodialysis reversal,
- ion exchange, and
- freeze desalination.

The primary disadvantage of distillation is the high cost. Also, distillation will not remove most volatile substances (including many currently regulated synthetic organic compounds). Reverse osmosis is effective in removing contaminants but has a very high cost ($1.00 to $7.00 per 1,000 gallons). Electrodialysis and electrodialysis reversal (ED/EDR) will not remove uncharged molecules and therefore will not remove organic compounds). Ion exchange is rarely used for salt removal on a large scale and the disposal of wastes pose significant economic and environmental problems. Freeze desalination is very complicated and in the early stages of development. Also, it is most feasible in areas where the ambient temperature remains below freezing for extended periods of time. (CCWD 1992).

Because of the cost, effectiveness and environmental problems associated with these desalination alternatives, they were removed from further analysis.

Other Reservoir Sites

Under the Other Reservoir Sites alternatives, DW would secure rights to a quality of water from the Delta, then divert that water and convey it to an offsite reservoir site for storage. When needed, the water would be transported back to the Delta for sale to the CVP or SWP. Thirty-two alternative sites throughout Contra Costa County were considered (CCWD 1992).

All of these alternative reservoir sites have significant problems associated with them including economic feasibility, environmental impacts, and technical constraints. Because of these problems, all alternative reservoir site alternatives were removed from further analysis.

ONSITE STRUCTURAL ALTERNATIVES

The onsite DW project alternatives represent a range of project operations that would meet the basic project purpose. Any of the configurations could provide high-quality water in the Delta for export or outflow over the long term. The onsite alternatives would be implemented on the four islands presently owned wholly or in part by DW and therefore are available to the project proponent. The onsite alternatives are generally financially feasible. All onsite alternatives would operate in full compliance with the objectives of the 1995 WQCP and all other applicable Delta water quality criteria, endangered species protection measures, and water system operational constraints.

The onsite alternatives are practicable operational scenarios that would meet the basic project purpose and were carried forward for analysis in the EIR/EIS.

Alternatives 1 and 2

As described in Section 3, DW's proposed project is represented by two operational scenarios, Alternatives 1 and 2, which differ only with regard to operating criteria for discharge of stored water. The proposed project consists of operation of Bacon Island and Webb Tract (reservoir islands) for their maximum water storage capabilities and Bouldin Island and Holland Tract (habitat islands) for their wetland and wildlife habitat values. During nonstorage periods, incidental shallow-water wetlands and waterfowl habitat would be available on the reservoir islands.

Alternative 3

Under this alternative, all four DW islands (Bacon and Bouldin Islands and Holland and Webb Tracts) would be operated for their maximum water storage capabilities. Diversions and discharges to the islands would be conducted sequentially to maximize seasonal wetland and waterfowl habitat during the nonstorage periods.

Levees on the islands would be constructed for maximum pool elevations of +6 feet. DW diversion and discharge operations would be the same as under Alternative 2.

FIRST-STAGE EVALUATION

The first-stage evaluation generally analyzes the alternatives to eliminate those that would not reasonably meet the overall project purpose but does not strictly define practicable alternatives. A summary of the first-stage screening evaluation is presented in Table 5-1.

No-Project Alternative

The No-Project Alternative would not satisfy the project purpose. Under this alternative, intensified agriculture would be conducted on the four project islands. This activity would decrease the supply of high-quality water in the Delta. This alternative would not contribute to meeting the existing and future needs for high-quality water in the Delta for export and outflow.

The No-Project Alternative was eliminated from further evaluation as a practicable alternative to the proposed project because it would decrease the availability of high-quality water in the Delta for sale as export south of the Delta or as outflow to San Francisco Bay.

Reoperation of the SWP and the CVP

Reoperation of the SWP and the CVP, as described above, would require combined management of the SWP and the CVP to increase the operational flexibility of the two projects and therefore result in a more efficient water storage and delivery system. This alternative could increase the supply of high-quality water in the Delta for sale to export south of the Delta or Delta outflow to San Francisco Bay.

To facilitate coordinated management and increased flexibility of the two water management systems, Governor Wilson and U.S. Secretary of the Interior Manuel Lujan signed a Memorandum of Agreement in March 1992 that outlined the process for transferring the CVP to California for control. Such a transfer will require authorizing legislation by Congress, environmental assessments under NEPA and CEQA, and negotiation of detailed terms and conditions for the transfer. The memorandum recognized that the transfer process will require many years to complete.

CVP facilities are operated for several distinct, and at times conflicting, purposes, including water supply for agricultural and urban uses, hydroelectric power generation, water quality maintenance, flood control, navigation, recreation, and fish and wildlife benefits. Many institutional, legal, and economic considerations are associated with the transfer of the CVP.

This alternative has not been sufficiently defined to determine whether it could achieve the project purpose of increasing the supply of high-quality water in the Delta. It is presently impossible to estimate how much water the combined management of the SWP and the CVP would yield to increase the quantity of high-quality water in the Delta.

Reoperation of the SWP and the CVP is unavailable to the project proponent. A role for a private participant in the management of an integrated SWP and CVP system does not exist. Financial implications of the reoperation of the SWP and the CVP are uncertain. The alternative could require substantial financial investments to evaluate, negotiate, plan, and implement CVP transfer and coordinated management of the two systems.

Reoperation of the SWP and the CVP is eliminated from further evaluation as a practicable alternative to the proposed project. This alternative cannot be defined sufficiently to determine whether it would increase the availability of high-quality water in the Delta. Additionally, this alternative is unavailable to DW and could have substantial financial limitations.

Water Conservation Alternative

Under this alternative, water conservation programs would be implemented for urban and agricultural water users to increase the supply of high-quality water in the Delta for export south of the Delta or Delta outflow to San Francisco Bay. DWR (1994) evaluated water conservation as an option to reduce the long-term demand for water in California. Permanent reductions in demand are expected from urban water conservation under the Memorandum of Understanding (MOU) Regarding Urban Water Conservation, adopted by more than 100 major urban water agencies as of December 1992. Under the MOU, best management practices are to be implemented by the water agencies by 2001.

Under state and federal legislation, agricultural water conservation is also expected to permanently reduce water demand. The CVPIA requires more intensive agricultural water conservation. California Assembly Bill 3616 required DWR to develop a list of efficient water management practices to be implemented by agricultural water users. Retirement of marginal agricultural lands (e.g., poorly drained soils in the San Joaquin Valley) will also permanently reduce water demand. (DWR 1994.)

DWR (1994) estimated that urban and agricultural water conservation programs might achieve 3 MAF of demand reduction statewide by 2020. This demand reduction was accounted for in the DWR (1994) projections for long-term California water demand. It is not possible to estimate the extent to which a reduction in California water demand would reduce demand in the Delta watershed, or how a reduction in demand in the Delta might contribute to increased Delta water supply. Therefore, the water conservation alternative cannot be defined sufficiently to conclude that it would be able to satisfy the project purpose.

Water conservation, on a very small scale, is available to the project applicant. DW could implement water conservation efforts for intensified agricultural uses on its four Delta islands, but these efforts would not generate a measurable supply of water for sale as export or outflow. Conservation on a scale broad enough to have the potential to supply a minimum amount of water would require public, institutional, local agency, private industry, and agricultural community participation, and would therefore be unavailable to DW.

The water conservation alternative was eliminated from further evaluation as a practicable alternative to the proposed project. This alternative cannot be defined sufficiently to determine whether it would increase the availability of high-quality water in the Delta. Additionally, this alternative is unavailable to DW.

Water Transfers Alternative

This alternative could potentially satisfy the project purpose. Voluntary, market-based temporary and long-term water transfers directly using the Delta could increase the supply of high-quality water in the Delta for sale as export and/or outflow.

The water transfers alternative may be available to the project proponent. Although DW could act as a type of broker for potential suppliers and buyers of market water, the feasibility of this role is highly speculative. The role DW would play in this alternative is not defined clearly enough for proper evaluation of the financial feasibility of DW being a broker in the water transfers market. A broker may not have a financially feasible role in the water transfers market if suppliers and buyers contract directly with each other without the aid of a broker.

Water transfers can be short term (1 year or less) or long term. One long-term transfer has reached the detailed planning stage; under an agreement between MWD and Imperial Irrigation District, approximately 70 TAF produced by canal lining will be permanently transferred to MWD. Long-term transfers that could increase water supply to the Delta are not sufficiently definable to be considered a practicable alternative to meet the project purpose.

Many short-term water transfers were implemented through the State Drought Water Bank in 1991 and 1992 (DWR 1994). Short-term transfers are typically based on fallowing of irrigable agricultural land for short periods or on temporary shifts of supplies not needed by the seller on an interim basis. Because of the temporary or interim nature of these transfers, they cannot achieve the basic project purpose of long-term increase in Delta water supply.

The water transfers alternative was eliminated from further evaluation as a practicable alternative to the proposed project because:

- it would not realistically be available to the project proponent,
- it is not definable as a program of long-term transfers to increase Delta water supply,
- temporary transfers cannot meet the long-term project purpose, and
- it may have limited financial feasibility for DW as a participant.

Non-Delta Water Storage and Conjunctive Use

This alternative could potentially satisfy the project purpose. Under this alternative, a water storage facility could be constructed and operated to increase the long-term supply of high-quality water in the Delta. Similarly, a conjunctive use program could be developed to increase Delta water supplies in drought years.

DWR (1994) examined options, termed Level I, for increasing statewide water supplies using storage projects and conjunctive use that may be implementable by 2020. Three Level I options being pursued by state and federal agencies may potentially increase Delta water supplies or the efficiency of their management:

- Interim South Delta Water Management Program (to enhance circulation and allow use of additional Delta export pumping capacity),
- long-term Delta solution (including Los Banos Grandes Reservoir and Kern Water Bank) being studied by the Bay-Delta Oversight Council, and
- American River Flood Control Project to re-establish use of present Folsom Lake flood control reservation for water supply.

DWR (1994) also lists nine local water supply projects that may be implementable by 2020. Most of these are in coastal or southern California. The one local option upstream of the Delta (i.e., El Dorado County Water Agency) will reduce Delta inflow by approximately 24 TAF if it is implemented.

Another local option for level I water supply is the Los Vaqueros Project of CCWD; this project will be supplied by diversions from the Delta but theoretically could be operated to discharge water back to the Delta. The Los Vaqueros Project is designed to increase the reliability of CCWD water supplies, not to increase the amount of those supplies. Also, the Los Vaqueros Project has recently received its state and federal permits (e.g., Section 404) and is proceeding with construction this year. Adding to the storage capacity of the Los Vaqueros Project as an alternative to the proposed project is not practicable because the capacity of Los Vaqueros is unavailable to DW and the two projects have different purposes and are in different stages of permitting.

Thus, none of the Level I local options appeared to be able to meet the basic project purpose of increasing long-term Delta water supplies.

DWR (1994) lists Level II water supply options that require extensive investigation and analysis before they may be implementable. Potential Level II storage projects that could increase Delta water supplies consist of the Red Bank Project (new reservoirs in Cottonwood Creek watershed), Shasta Lake Enlargement, Clair Engle Lake Enlargement, Westside (Sacramento Valley) Reservoirs, and American River Watershed Investigation. Examinations of these options are on hold indefinitely or delayed because of the need to first resolve Delta water management issues or because of their high costs (DWR 1994).

DWR is actively conducting studies of two Level II conjunctive use programs that could increase Delta water supplies in drought years: the Stanislaus-Calaveras River Water Use Program and the Sacramento Valley Conjunctive Use Program. Under these conjunctive use programs, surface water is diverted from rivers and used for agricultural irrigation and groundwater recharge during wet years. During dry years, however, irrigation water is pumped from groundwater, and surface water is left in the rivers to contribute to Delta inflow.

These types of conjunctive use programs require sponsorship and direction by regional water districts that coordinate management of large areas of irrigated farmland and defined groundwater basins in combination with centralized points for surface water diversions. Therefore, a conjunctive use water management program does not appear to be available to the project proponent. Furthermore, a conjunctive use program would not increase Delta water supplies over the long-term but could increase Delta inflows in dry years.

Non-Delta water storage and conjunctive use was eliminated from further evaluation as a practicable alternative to the proposed project for the following reasons:

- definable options that might be implemented under this alternative by 2020 are not available to the project proponent;
- other options require extensive investigation to determine their financial feasibility or their compatibility with a long-term Delta solution and thus are not currently definable; and
- conjunctive use programs might increase Delta water supplies only in drought years in addition to not being available to the project proponent.

Water Storage on Other Delta Islands

For the purposes of the first-stage evaluation, this was considered as one alternative, rather than an unlimited number of combinations of the 22 islands in the Delta other than the DW islands. This alternative would be able to satisfy the project purpose. Under this alternative, water would be stored on a combination of other Delta islands with sufficient capacity to reasonably increase the supply of high-quality water in the Delta, for sale as export south of the Delta or Delta outflow to San Francisco Bay. This alternative would have an operation plan and facilities similar to those of the proposed project.

Water storage on other Delta islands was generally available to the project proponent as an alternative to the proposed project at the time of initial project planning. Certain factors relating to cost, technical feasibility, and logistics particular to each Delta island may affect its feasibility as a potential site for water storage. Since this stage is a general level of analysis, however, this alternative is not removed from consideration as a practicable alternative.

Water storage on other Delta islands was carried forward as an alternative into the second-stage evaluation.

Onsite Alternatives

For purposes of the first-stage evaluation, the onsite alternatives, including the proposed DW project, will be considered as one alternative.

The onsite alternatives would be able to satisfy the project purpose. Any of the configurations could provide high-quality water in the Delta for export or outflow over the long term. The onsite alternatives would be implemented on the four islands presently owned by DW, and therefore are available to the project proponent. The onsite alternatives are generally financially feasible. All onsite alternatives would operate in full compliance with all applicable Delta water quality standards, endangered species protection measures, and water system operational constraints.

The onsite alternatives are practicable alternatives to the proposed project and were carried forward into the second-stage evaluation.

SECOND-STAGE EVALUATION

The second-stage evaluation analyzed in greater detail the alternatives carried forward from the first-stage evaluation. The screening criteria were rigorously applied to each alternative to identify practicable alternatives to the proposed project. This stage closely analyzed the alternative's ability to satisfy the project purpose in light of the alternative's availability and logistical, technological, and financial feasibility.

Water storage on other Delta islands and onsite alternatives were analyzed in the second-stage screening.

Water Storage on Other Delta Islands

An island-by-island assessment was required to analyze which islands could substitute for Bouldin and Bacon Islands and Holland and Webb Tracts in the proposed project. Table 5-2 presents characteristics affecting the practicability of each Delta island as it compares with the DW project islands.

Each Delta island's physical characteristics are analyzed to address whether the island could by itself, or in combination with other islands, meet the project purpose. The availability of each island was considered at the time when DW started planning the proposed project in 1987. As discussed below, six islands were unavailable to the project proponent because of unwilling sellers.

During this part of the planning stage DW also made cost assessments to determine whether certain islands in the Delta should be eliminated from consideration for the project. As discussed below, the use of certain islands in the project would have resulted in rates of return in the range of 2%-8.5% (see Table 5-2). These islands were eliminated as financially infeasible because their rates of return did not even meet the minimum cost of borrowed funds in 1987 (10%) without risk factors being considered.

The remaining islands were excluded because they contained so many obstacles to the project (e.g., the EBMUD aqueduct crossing the island, the Santa Fe railroad, towns, etc.) that even without cost estimates, the islands were clearly financially infeasible.

Bradford Island

Bradford Island (2,051 acres) has an estimated raw storage capacity of 30 TAF. Although Bradford Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Bradford Island is unavailable to the applicant. At the time DW was pursuing purchase of islands for the proposed project, Bradford Island had multiple landowners "which would make it virtually impossible to assemble all of the acreage or at least enough to make a project on the island possible" (Winther pers. comm.). A 1992 DWR appraisal for purchase of Bradford Island reported that the state doubted it would be able to work out a purchase deal "that will please all 80 landowners" (Brown pers. comm.). Other factors that contribute to Bradford Island's elimination as a practicable alternative include the operating gas wells on the island (Winther pers. comm.).

Brannan-Andrus Island

Brannan-Andrus Island (13,000 acres) has an estimated raw existing storage capacity of 273 TAF. Although Brannan-Andrus Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A large portion of the island has land uses that would directly conflict with a water storage project and would require relocation or levee protection. These land uses include the town of Isleton, with an estimated population of 833 (DWR 1993); SR 12; SR 160; a county road; a PG&E transmission line; and operating gas wells. Approximately 11 commercial facilities, including trailer parks, marinas, and marina support facilities, are located along the southern and southeastern shorelines of the island. These facilities would be inundated if this island were part of the project because the facilities are located at very low elevations. Thus, these facilities would have to be purchased and closed down, or protected at a substantial cost. The combination of these logistical constraints make Brannan-Andrus Island financially infeasible.

Coney Island

Coney Island (935 acres) has an estimated raw storage capacity of 8 TAF. Although Coney Island could, in combination with other Delta islands, meet the project purpose, the small storage capacity (under 10 TAF) results in an estimated rate of return for the project proponent of 5.54%, rendering this island financially infeasible as a project island. This factor eliminates Coney Island from consideration as a practicable alternative.

Empire Tract

Empire Tract (3,430 acres) has an estimated raw storage capacity of 54 TAF. Although Empire Tract could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A county road crosses through the center of the island and would need to be protected by two separate DSOD levees or relocated. This requirement results in an estimated rate of return for the project proponent of 6.15%, rendering this island financially infeasible as a project island. Since market entry, an offsite wildlife mitigation plan has been approved for the Harbor Cove development on a major portion of Empire Tract north of the county road.

Jersey Island

Jersey Island (3,471 acres) has an estimated raw storage capacity of 52 TAF. Although Jersey Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Western Area Power Administration's (WAPA's) California-Oregon Transmission Project (COTP) (a major north-south electrical energy intertie) runs directly across the island, along with at least two gas transmission lines owned by PG&E. Operating gas wells are also located on the island. Additionally, a county road bisects the island and would require protection by two separate levees or relocated at substantial cost. The combination of these factors results in an estimated rate of return for the project proponent of 4.61%, rendering this island financially infeasible as a project island. Additionally, a major portion of this island is now owned by Ironhouse Sanitary District, which is designing a sewage treatment effluent disposal facility to be located on the island.

Lower Jones Tract

Lower Jones Tract (5,894 acres) has an estimated raw storage capacity of 88 TAF. Although Lower Jones Tract could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A portion of the tract has land uses that would directly conflict with a water storage project and would require relocation or DSOD levee protection. These land uses include the Santa Fe Railroad. The Santa Fe Railroad embankment was not constructed to be a levee, as demonstrated by flooding from a levee break in the early 1980s. Therefore, its 5-mile length across Lower Jones Tract would have to be protected by a new levee constructed to

DSOD standards, which results in an estimated rate of return for the project proponent of 7.58%, rendering this island financially infeasible as a project island.

Upper Jones Tract

Upper Jones Tract (6,259 acres) has an estimated raw storage capacity of 68 TAF. Although Upper Jones Tract could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A portion of the tract has land uses that would directly conflict with a water storage project and would require relocation or DSOD levee protection. These land uses include the Santa Fe Railroad (see "Lower Jones Tract" above), a PG&E substation, a county road that bisects the island, and the EBMUD aqueduct.

The EBMUD aqueduct is a particularly difficult issue for logistical feasibility of water storage. The aqueduct serves water to the urban areas on the east side of San Francisco Bay. It was threatened in the early 1980s, when flood waters from a levee break on Lower Jones Tract breached the Santa Fe Railroad embankment and eroded foundations of the aqueduct. EBMUD strongly opposes a water storage project on any of the islands crossed by its aqueduct because of erosion risks from flooding to the water supply reliability for its service area.

Additionally, the county road and the railroad would require relocation or protection by two DSOD levees, which results in an estimated rate of return for the project proponent of 3.16%, rendering this island financially infeasible as a project island.

King Island

King Island (3,260 acres) has an estimated raw storage capacity of 39 TAF. Although King Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A county road crosses the center of the island and provides service to at least four commercial operations. The road would need to be relocated or protected by two separate DSOD levees, which results in an estimated rate of return for the project proponent of 4.03%, rendering this island financially infeasible as a project island.

Little Mandeville Island

Little Mandeville Island (376 acres) has an estimated raw storage capacity of 2 TAF. Although Little Mandeville Island could, in combination with other Delta islands, meet the project purpose, the small storage capacity (under 10 TAF) results in an estimated rate of return for the project proponent of 2.08%, rendering this island financially infeasible as a project island.

Mandeville Island

Mandeville Island (5,300 acres) has an estimated raw storage capacity of 100 TAF. Although Mandeville Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Mandeville Island was unavailable to the project applicant during the project planning stage. DW reported that, at the time it was pursuing purchasing islands for the proposed project, the majority owner refused to consider selling the island unless he was told of the planned purpose for the site. When told that this information would not be divulged, the majority owner then refused to sell the island for less than $22.5 million. DW estimates that this sale price was three times the fair-market value for the island at that time (Winther pers. comm.), rendering the island unavailable to DW.

McDonald Island

McDonald Island (6,145 acres) has an estimated raw existing storage capacity of 104 TAF. Although McDonald Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A large portion of the island is occupied by a PG&E gas storage facility that requires continuous ground-level access. This is one of the largest facilities of this type on the west coast. PG&E requires daily vehicle and personnel access to its injection and withdrawal gas wells on this island to operate the underground gas storage facility. Inundation of that facility is completely unacceptable to PG&E, even though the pumping facilities were built on elevated platforms to avoid massive capital losses in the event of a short-term flood event.

Medford Island

Medford Island (1,219 acres) has an estimated raw storage capacity of 17 TAF. Although Medford Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Medford Island is unavailable to the project applicant. DW reported that, at the time it was pursuing purchasing islands for the proposed project, the main landowner of the island, the Klein Company, refused to sell the company's interest unless DW agreed to buy all of the company's agricultural portfolio, including several thousand acres throughout the Delta and nearby areas (estimated price of $30 million). DW estimates that the resale of the unneeded land would have resulted in an immediate loss of approximately $15 to $20 million (Winther pers. comm.). A representative of the company later indicated that no counter-offer existed and the family simply did not want to sell.

Mildred Island

In 1983, Mildred Island suffered a levee breach and has gone unreclaimed since that time. As a result, the surface area is considered by the Corps to be jursidictional wetlands (988 acres). Because of the present wetland condition and the total disrepair of the levees, the cost to reclaim and convert to a reservoir would be very high. The 4.22% rate of return renders this island financially infeasible as a project island.

Orwood Island

Orwood Island (4,138 acres) has an estimated raw storage capacity of 57 TAF. Although Orwood Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A portion of the tract has land uses that would directly conflict with a water storage project and require relocation or DSOD levee protection. These land uses include the Santa Fe Railroad, a county road that services a marina, and the EBMUD aqueduct. As stated previously under "Upper Jones Tract", EBMUD is opposed to water storage on islands crossed by its aqueduct. The logistical constraints of the railroad, county road, and EBMUD aqueduct cause Orwood Island to be incompatible with reservoir operations.

High prices for land on Orwood Tract also cause this island to be financially infeasible. A large parcel on Orwood Tract recently sold for $5,500 per acre, indicating that the purchase price for the island would be more than $22 million. In addition to the logistical constraints described above, the high-market price for land on Orwood Tract eliminates this island from further consideration.

Palm Tract

Palm Tract (2,436 acres) has an estimated raw storage capacity of 31 TAF. Although Palm Tract could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. The Santa Fe Railroad, which runs across the tract, would conflict with a water storage project and would require relocation or DSOD levee protection, which results in an estimated rate of return for the project proponent of 6.31%, rendering this island financially infeasible as a project island. In addition, the eastern portion of Palm Tract is committed to a long-term HMP for mitigation of the COTP project.

Quimby Island

Quimby Island (769 acres) has an estimated raw storage capacity of 8 TAF. Although Quimby Island could, in combination with other Delta islands, meet the project purpose, the small storage capacity (under 10 TAF) results in an estimated rate of return for the project proponent of 5.66%, rendering this island financially infeasible as a project island.

Rindge Tract

Rindge Tract (6,834 acres) has an estimated raw storage capacity of 102 TAF. Although Rindge Tract could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Rindge Tract is unavailable to the project applicant. DW reported that, at the time it was pursuing purchasing islands for the proposed project, conditional offers were made to the landowners on Rindge Tract. Although several acceptances were received, the main landowner of the island, the Klein Company, refused to sell the company's interest (similar to DW's experience with Medford Island) unless DW agreed to buy all of the company's farmland in the Delta (estimated price of $30 million). DW estimates that the resale of the unneeded land would have resulted in an immediate loss of approximately $15 to $20 million (Winther pers. comm.).

Lower Roberts Island

Lower Roberts Island (10,600 acres) has an estimated raw storage capacity of 169 TAF. Although Lower Roberts Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. A large portion of the island has land uses that would directly conflict with a water storage project and would require relocation or DSOD levee protection. These land uses include the Santa Fe Railroad, SR 4, county roads, the EBMUD aqueduct, and WAPA transmission line. As described above for Upper Jones Tract, EBMUD is opposed to reservoir operations on islands crossed by its aqueduct.

Additionally, a large elementary school is located at the intersection of McDonald Road and Holt Road, which would be flooded if this island were used as part of the DW project. In addition, the City of Stockton has a sewage treatment facility at the southeast corner of Middle Roberts Island, which is not separated from Lower Roberts Island by a levee. Thus, these facilities would have to be relocated or protected by DSOD levees.

The logistical constraints of the railroad, state road, county roads, aqueduct, transmission line, school, and sewage treatment facility cause Lower Roberts Island to be financially infeasible as a project island (Winther pers. comm.).

Staten Island

Staten Island (9,173 acres) has an estimated raw storage capacity of 146 TAF. Although Staten Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Staten Island is unavailable to the project applicant. DW reported that, at the time it was pursuing purchasing islands for the proposed project, the landowner, M&T Ranches, was owned by Kolberg, Kravis & Roberts. Kolberg, Kravis & Roberts refused to sell Staten Island without the sale of all other M&T Ranches properties. The sale price of Staten Island was therefore significantly above fair-market value (Winther pers. comm.) and the island was thus unavailable as a project island.

Staten Island is a well-known and highly protected winter roosting area for the greater sandhill crane, a state-listed endangered species. Also, land uses on the island could conflict with water storage operations on the island. These land uses include an extensive farming operation, including a grain dryer and silos; a county road running through the center of the island, which would require DSOD levee protection; and operating gas wells. The potential impact on the endangered species habitat and the factors affecting financial feasibility also contribute to the elimination of this island as a practicable alternative (Winther pers. comm.).

Twitchell Island

Twitchell Island (3,516 acres) has an estimated raw storage capacity of 63 TAF. Although Twitchell Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Operating gas wells and county roads on the island would need DSOD levee protection; these requirements, in combination, result in an estimated rate of return for the project proponent of 8.58%, rendering this island financially infeasible as a project island. Additionally, Twitchell Island is also predominantly owned by DWR and is being converted to wetlands.

Venice Island

Venice Island (3,220 acres) has an estimated raw storage capacity of 54 TAF. Although Venice Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. Venice Island is unavailable to the project applicant. DW reported that the island was owned by two entities, Denapolis and a duck club, during the project planning stage. Venice Island is considered one of the premier waterfowl shooting areas in California. The recreation areas include extensive capital improvements. Two exploratory efforts made by DW's agent resulted in a determination that the island was not for sale (Winther pers. comm.).

Victoria Island

Victoria Island (7,250 acres) has an estimated raw storage capacity of 101 TAF. Although Victoria Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. SR 4, which runs across the center of the island, would conflict with a water storage project and require relocation or DSOD levee protection. This results in an estimated rate of return for the project proponent of 6.06%, rendering this island financially infeasible as a project island. The island was also part of the South Delta Program at the time of market entry and therefore use of the island by DW would have been opposed by DWR. In addition, the COTP line runs across this island.

Woodward Island

Woodward Island (1,822 acres) has an estimated raw storage capacity of 27 TAF. Although Woodward Island could, in combination with other Delta islands, meet the project purpose, other factors eliminate it from consideration as a practicable alternative. The EBMUD aqueduct directly conflicts with a water storage project and would require relocation or DSOD levee protection (see discussion above for Upper Jones Tract). This results in an estimated rate of return for the project proponent of 5.75%, rendering this island financially infeasible as a project island.

Onsite Alternatives

One-Island Alternative

Under the One-Island Alternative, one of the four project islands would become a reservoir, one island would become habitat to offset the impacts on the reservoir island, and intensified agricultural operations would be conducted on two islands (as described under the No-Project Alternative on page 5-1). For the purposes of this analysis, the reservoir island is assumed to be Webb Tract because it has the largest storage potential of the four project islands. The habitat island is assumed to be Bouldin Island because it would provide the most habitat value. Agricultural operations are assumed to occur on Bacon Island and Holland Tract.

The use of Webb Tract as a reservoir island would provide additional storage of 120 TAF. This is considerably below the minimum water storage capacity of 200 TAF required for the DW project to be feasible. This feasibility is based on cost factors and on institutional factors related to DWR requirements that are detailed in Section 4, under "Financial Limitations".

Because the One-Island Alternative would not be financially or institutionally feasible, it was removed from further analysis.

Multiple-Island Alternatives

All onsite alternatives other than the one-island alternative would operate in full compliance with all applicable Delta water quality objectives, endangered species, protection measures, and water system operational constraints. The onsite alternatives are considered practicable alternatives to the proposed project. Each onsite alternative could, by itself, meet the project purpose. Each onsite alternative has the same basic method of operation that would allow it to increase the supply of high-quality water in the Delta for later sale as export or outflow. Each onsite alternative is available to the project proponent. Also, none of the onsite alternatives involves logistical factors that would make it financially infeasible as a practicable alternative to the proposed project.

The onsite alternatives passed the second-stage evaluation and are thus considered to be practicable alternatives to the proposed project. These alternatives will be analyzed in the third-stage evaluation represented by the impact assessments in the EIR/EIS being prepared for the proposed project. In the EIR/EIS, detailed quantitative environmental impact assessments focusing on aquatic ecosystem impacts are presented. The EIR/EIS is being prepared for SWRCB and the Corps as lead agencies under CEQA and NEPA, respectively.

Table 5-1. Summary of Alternatives Analysis
First-Stage Screening Evaluation

Alternative	First-Stage Evaluation
No-Project Alternative (intensified agriculture)	Removed from consideration: ■ Does not meet project purpose
Reoperation of the CVP and the SWP	Removed from consideration: ■ Not definable regarding ability to meet project purpose ■ Not available to project proponent
Water conservation alternative	Removed from consideration: ■ Not definable regarding ability to meet project purpose ■ Not available to project proponent
Water transfers alternative	Removed from consideration: ■ Not definable regarding ability to meet project purpose ■ Not available to project proponent ■ Not financially feasible for project proponent
Non-Delta water storage and consumptive use	Removed from consideration: ■ Not definable regarding ability to meet project purpose ■ Not available to project proponent
Water Storage on other Delta islands	Carried to second stage
Onsite alternatives	Carried to second stage

Table 5-2. DW Project Feasibility Analysis for Water Storage on Other Delta Islands

	Small Islands Excluded because of Size			Islands Excluded because of Other Factors									
	Coney	L. Mandeville	Quimby	Empire	Jersey	Lower Jones	Upper Jones	King	Palm	Twitchell	Victoria	Woodward	Mildred
Basic Data													
Area (acres)	935	376	769	3,430	3,471	5,894	6,259	3,260	2,436	3.516	7,250	1,822	998
Levee (miles)	5.4	4.5	7.0	10.5	15.6	8.8	9.3	9.0	7.5	9.3	15.1	8.8	7.3
Storage (TAF)	8	2	8	55	52	88	69	39	32	63	102	27	14
DSOD levees (miles)	0.00	0.00	0.00	4	6	5	13	4	2	3	8	2	0.00
Gas wells (each)	0.00	0.00	0.00	0.00	6	0.00	0.00	0.00	0.00	13	0.00	0.00	0.00
Land Costs ($ millions)													
Base price[a]	1.7	0.6	1.2	5.1	5.2	13.0	13.8	8.2	3.7	5.3	16.0	2.7	0.5
Other costs[b]	0.00	0.00	0.00	3.4	0.00	0.00	0.00	6.5	0.00	0.00	0.00	0.00	0.00
Interest costs[c]	0.6	0.2	0.4	2.8	1.7	4.3	4.6	4.9	1.2	1.7	5.3	0.9	0.2
Subtotal	2.3	0.8	1.6	11.4	6.9	17.3	18.3	19.5	4.9	7.0	21.2	3.6	0.7
Entitlements ($ millions)													
Fixed costs	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Variable costs[d]	0.9	0.4	0.8	3.4	3.5	5.9	6.3	3.3	2.4	3.5	7.3	1.8	1.0
Interest costs	0.2	0.1	0.2	0.5	0.5	0.7	0.8	0.4	0.4	0.5	0.9	0.3	0.2
Subtotal	2.1	1.5	2.0	4.9	4.9	7.6	8.0	4.7	3.8	5.0	9.1	3.1	2.2

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Table 5-2. Continued

	Small Islands Excluded because of Size			Islands Excluded because of Other Factors									
	Coney	L. Mandeville	Quimby	Empire	Jersey	Lower Jones	Upper Jones	King	Palm	Twitchell	Victoria	Woodward	Mildred
Mitigation ($ millions)													
Fixed costs	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Variable costs[e]	0.9	0.4	0.8	3.4	3.5	5.9	6.3	3.3	2.4	3.5	7.3	1.8	1.0
Subtotal	2.9	2.4	2.8	5.4	5.5	7.9	8.3	5.3	4.4	5.5	9.3	3.8	3.0
Construction ($ millions)													
Fixed costs	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Variable costs[f]	0.4	0.1	0.4	2.7	2.6	4.4	3.4	2.0	1.6	3.2	5.1	1.4	0.7
Variable levee costs[g]	2.7	2.3	3.5	5.3	7.8	4.4	4.7	4.5	3.8	4.7	7.6	4.4	18.3
DSOD levees and other[h]	0.00	0.00	0.00	40.0	61.0	50.0	130.0	40.0	20.0	32.0	80.0	20.0	0.00
Subtotal	4.8	4.1	5.6	49.7	73.0	60.5	139.8	48.2	27.0	41.5	94.3	27.5	20.7
Rate of Return													
Total project cost ($ millions)	12.2	8.7	12.0	71.4	90.3	93.3	174.4	77.6	40.1	59.0	133.9	38.0	26.5
Yield[i] (TAF)	7	2	7	44	42	71	55	31	25	51	81	22	11
Sell price ($/af)	125	125	125	125	125	125	125	125	125	125	125	125	125
Operation cost ($/af)[j]	25	25	25	25	25	25	25	25	25	25	25	25	25
Net revenue ($/af)	100	100	100	100	100	100	100	100	100	100	100	100	100
Rate of return[k] (%)	5.54	2.08	5.66	6.15	4.61	7.58	3.16	4.03	6.31	8.58	6.06	5.75	4.22

Note: All costs are based on 1987 dollars and market entry assumptions. Numbers may not total correctly because of rounding.

[a]Land "base price" represents seller's valuation of property purchase price.

[b]"Other" land costs include nonagricultural improvements (e.g., clubhouse).

[c]Land "interest" costs assume land held for 3 years, interest = 10.00%.

Table 5-2. Continued

[d]Variable cost of entitlement was calculated at $0.001 million/acre.

[e]Variable cost of mitigation was calculated at $0.001 million/acre.

[f]Variable cost of construction was calculated at $0.050 million/TAF.

[g]Variable cost of levees was calculated at $0.5 million/mile (based on information from Hultgren Geotechnical Engineers).

[h]Variable DSOD cost was calculated at $10.0 million/mile; variable gas well protection cost was calculated at $0.150 million/each (based on information from Tri-Valley Oil & Gas Company).

[i]Effective project yield was assumed to be 80.00% of storage capacity.

[j]Operating costs for alternate islands exclude fixed portions of costs.

[k]Rate of return does not include cost of capital associated with total project cost.

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Section 6. Summary of Findings

This alternatives analysis addresses the DW project's purpose of diverting surplus Delta inflows, transferred water, or banked water for later sale and/or release for Delta export or to meet water quality or flow requirements for the Bay-Delta estuary. It also addresses the incidental DW project purpose of providing managed habitat areas and water-related recreational uses. Standardized evaluation criteria are used to analyze the practicability of alternatives to the proposed project. This alternatives analysis identifies and evaluates a reasonable range of alternatives, including nonstructural, offsite, and onsite alternatives, to determine whether potential alternatives are able to satisfy the project purpose, are available to the project proponent, and are financially feasible (in relation to cost, technology, and logistics).

The alternatives analysis comprises three stages presented in Section 5 of this report. The first-stage evaluation (see Table 5-1) generally analyzed the alternatives to determine those that would not reasonably meet the overall project purpose or that cannot be sufficiently defined for their ability to meet the project purpose to be defined. The first-stage evaluation eliminated the following alternatives from consideration as practicable alternatives to the proposed project: the No-Project Alternative, reoperation of the CVP and the SWP, the water conservation alternative, the water transfers alternative, non-Delta water storage and consumptive use, Sierra supply sources, groundwater management, and desalination. The first-stage evaluation concluded that, after a general level of analysis, the practicable alternatives to the proposed project were water storage on other Delta islands and the onsite structural alternatives.

The second-stage evaluation analyzed in greater detail the alternatives carried forward from the first-stage evaluation. The second-stage evaluation eliminated the combinations encompassed by water storage on other Delta islands and the one-island alternative from consideration as practicable alternatives to the proposed project (see Table 5-2). The second-stage evaluation concluded that the onsite multiple-island alternatives for the proposed DW project are practicable alternatives to the proposed project.

The onsite alternatives carried to the third-stage evaluation will be analyzed in the draft EIR/EIS being prepared for SWRCB and the Corps. The onsite alternatives include the project originally proposed by DW in 1987, the four-island water storage alternative (now designated Alternative 3). The original proposed project did not include lands dedicated to wetland habitat management as the current proposed project does. A draft EIR/EIS was prepared on the original proposed project in 1990.

Since 1990, DW has worked with the lead agencies, the Corps and SWRCB, and EPA to identify and select a "less damaging practicable alternative" to the original proposed project. Based on those discussions and consultations, DW developed its current proposed project (represented by Alternatives 1 and 2) in 1993. Thus, the onsite alternatives include both the original proposed project (four reservoir islands) and two less damaging practicable alternatives to the proposed project (two reservoir islands and two habitat islands). The impacts of the four-island and two-island alternatives, which are analyzed in detail in the draft EIR/EIS, bracket the environmental impacts of a three-island alternative. A three-island alternative was not specifically analyzed but rather subsumed in the analysis of the other alternatives.

The third-stage evaluation will consist of detailed environmental impact analysis of the onsite alternatives, focusing on aquatic ecosystem impacts. The EIR/EIS for the DW project will identify a least environmentally damaging practicable alternative. With the information presented in the alternatives analysis and the EIR/EIS, the project applicant's Section 404(b)(1) compliance report will present the least environmentally damaging practicable alternative, along with a discussion of the steps taken to avoid, minimize, and compensate for impacts on the aquatic ecosystem. The Section 404(b)(1) compliance report will also include a discussion of public interest factors considered for the project.

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